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FEBRUARY 1971

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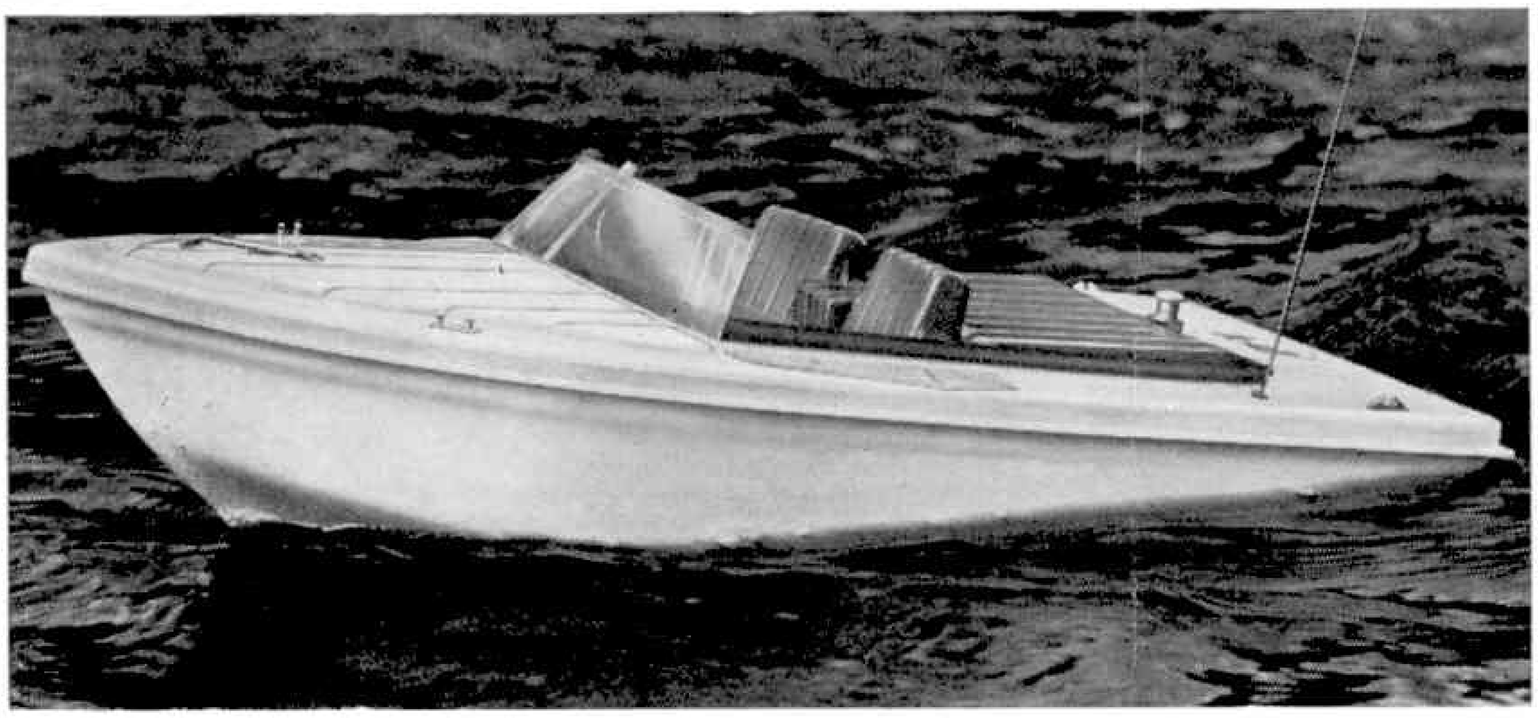

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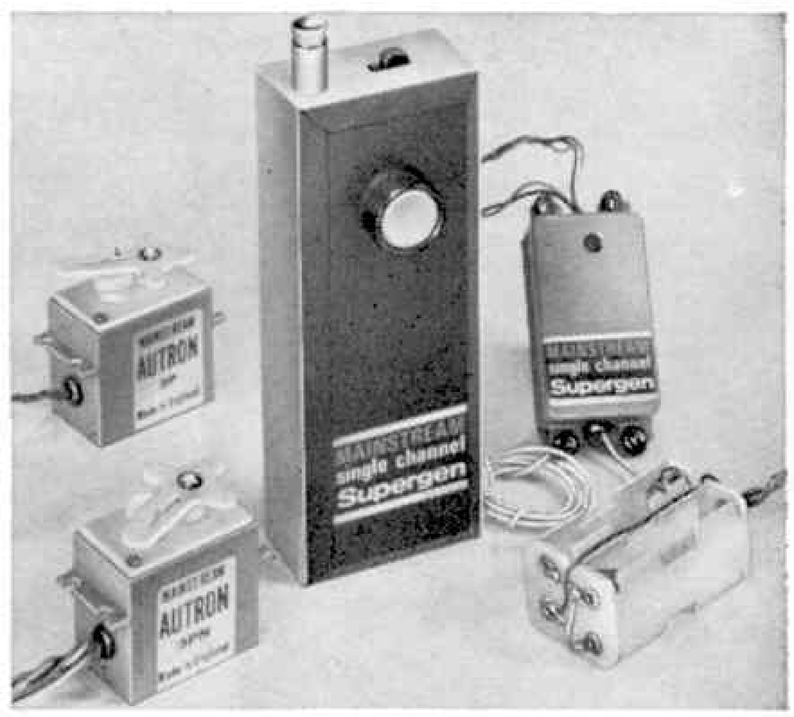

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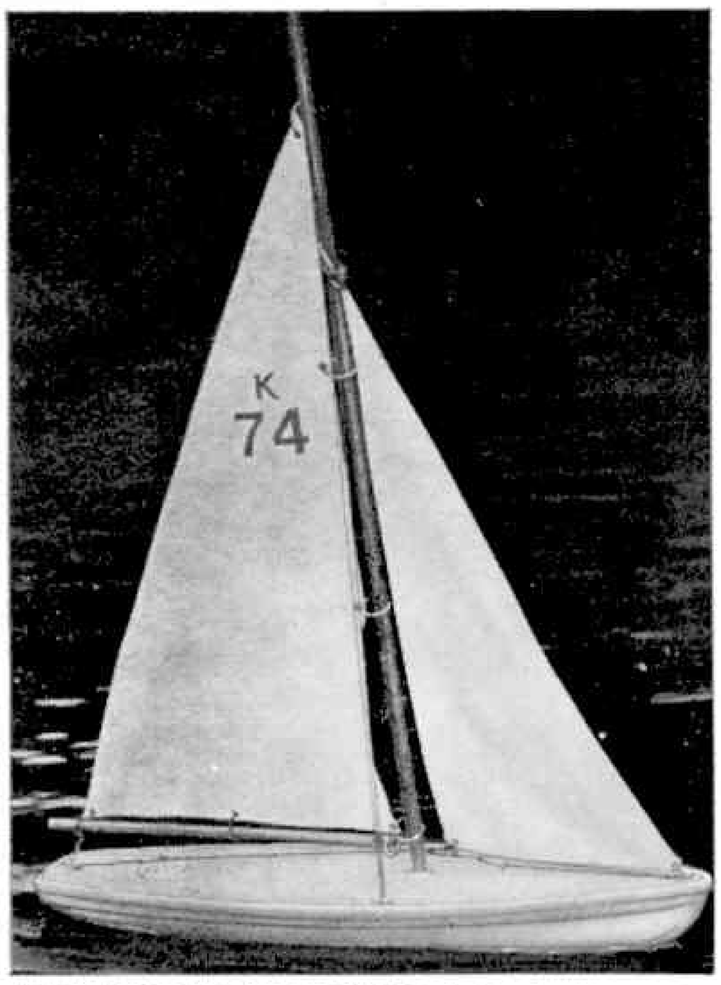

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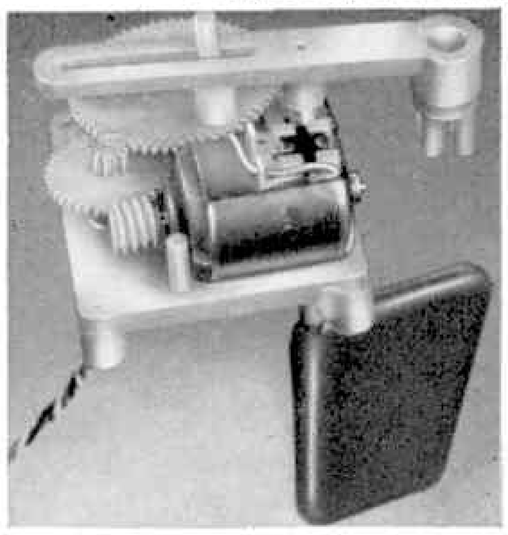

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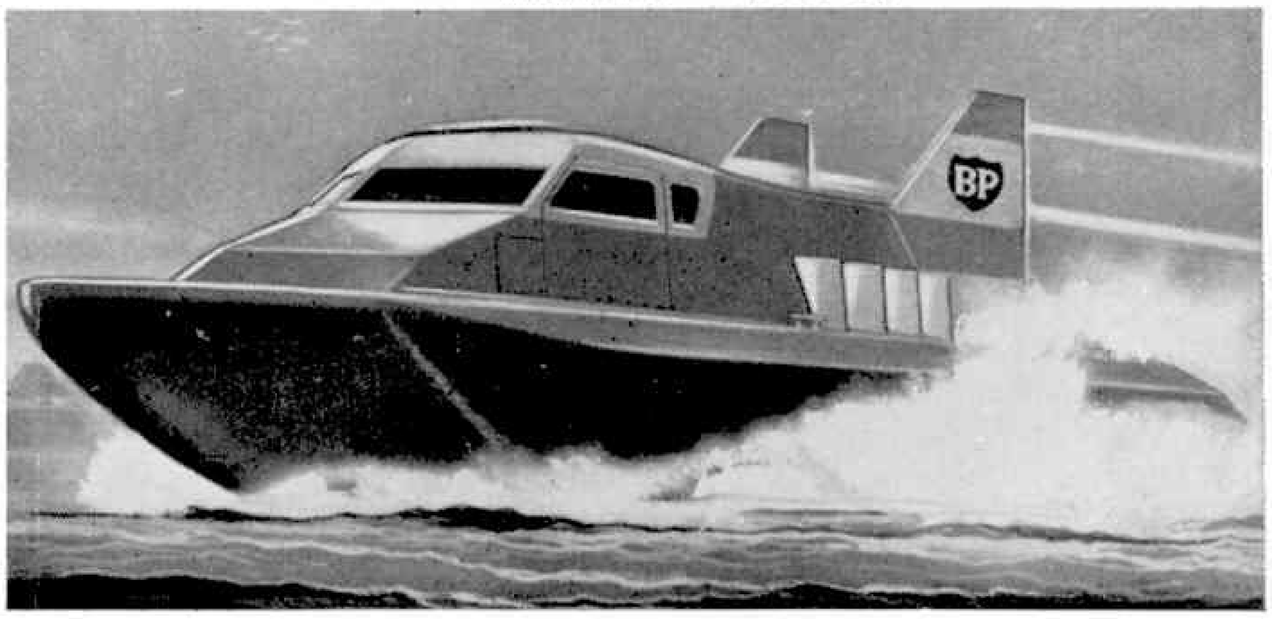

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MECCANO® Magazine

FEBRUARY 1971 VOLUME 56 NUMBER 2

Meccano Magazine, founded 1916.

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FRONT COVER

The attractive ship shown on our cover for this issue is the "Ben-My-Chree", one of the Manx ferries that commute between Douglas and Liverpool. S. R. Bawden took this photograph last summer as she manoeuvred astern into Liverpool after a crossing.

NEXT MONTH

We've got quite a number of new and interesting features lined up for inclusion in our March issue of Meccano Magazine. We kick-off with an interesting and unusual feature on the peat industry of Ireland, illustrated with numerous photographs and, from the pen of Richard Wiggan, who provides an article on Weather Ships on page 64 of this issue, comes another first-rate feature still on a "sea" theme; this time the story of the U.S. Coast Guard. A new contributor, P. Smith submits a delightfully informative feature on the life and work of Louis Braille, the originator of the Braille alphabet for the blind.

Meccano lovers are amply catered for in this issue with some truly interesting models which take the form of two simplicity models for younger builders, the Eiffel Tower and a model tram and a live steam wagon using the Meccano Steam Plant for the more advanced constructor.

These, plus others and of course all the regulars such as "Air News", "Have you Seen?", "Stamps" and "Among the Model Builders" all help to make another issue to look forward to.

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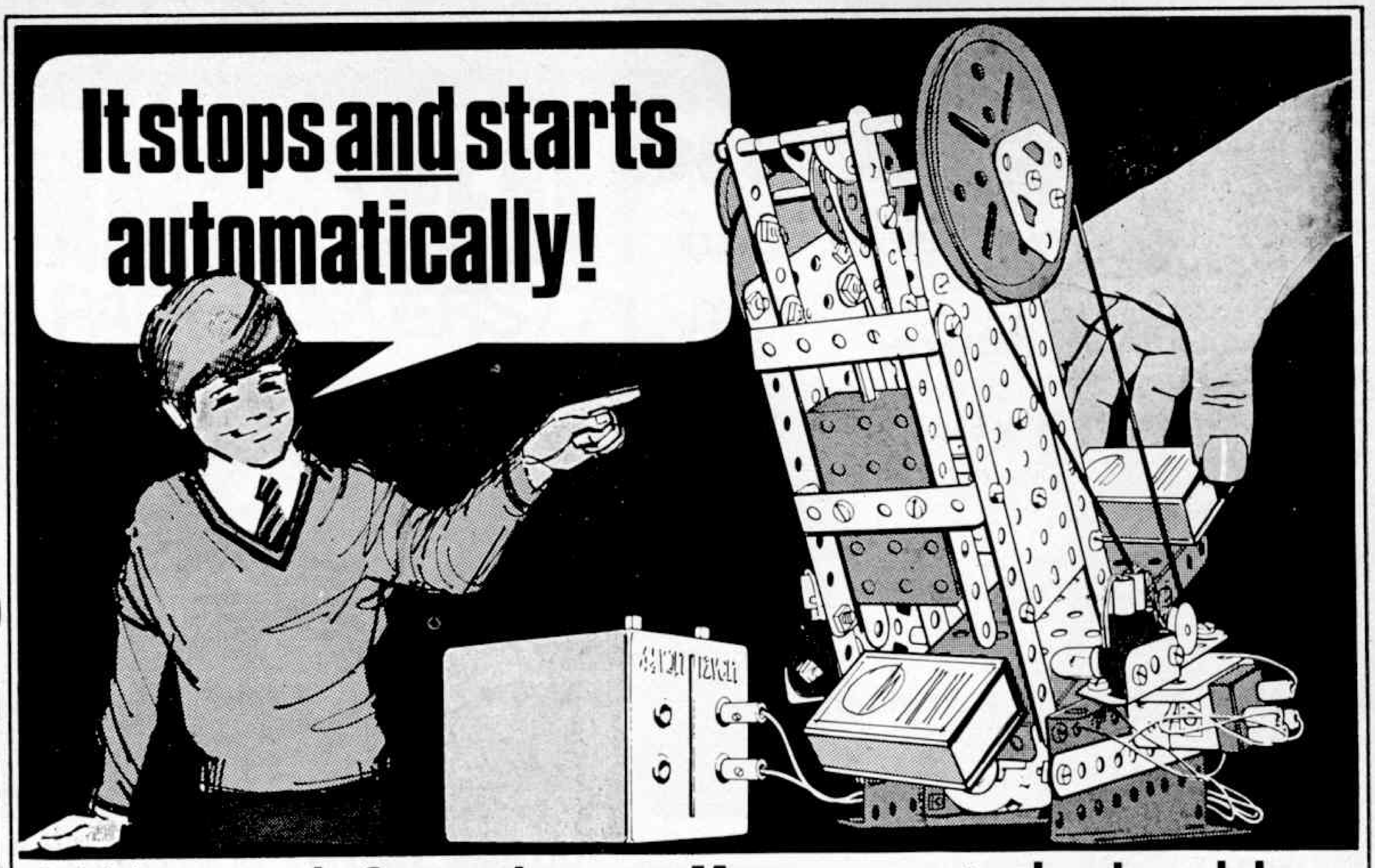
NEW MECCANO



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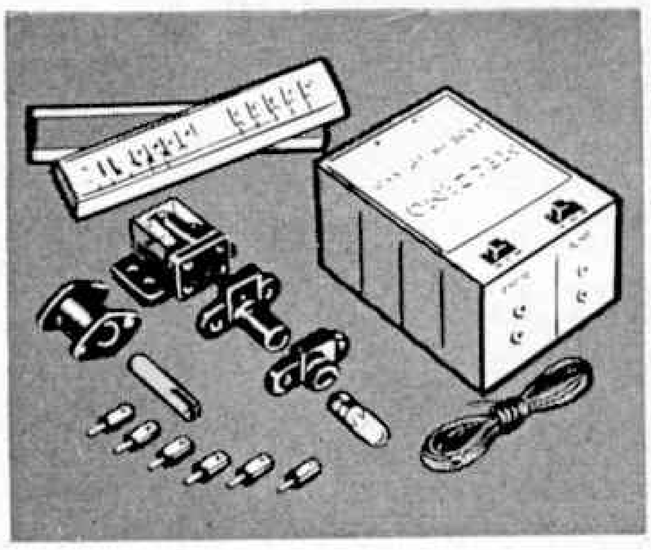

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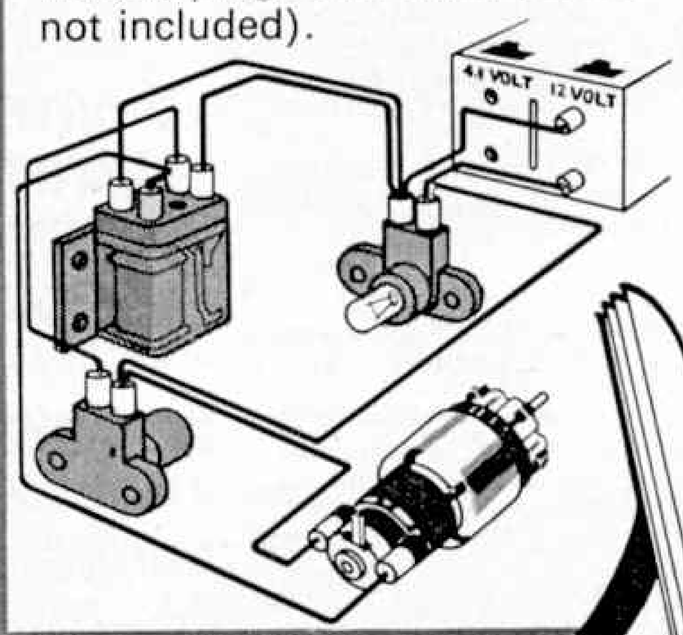

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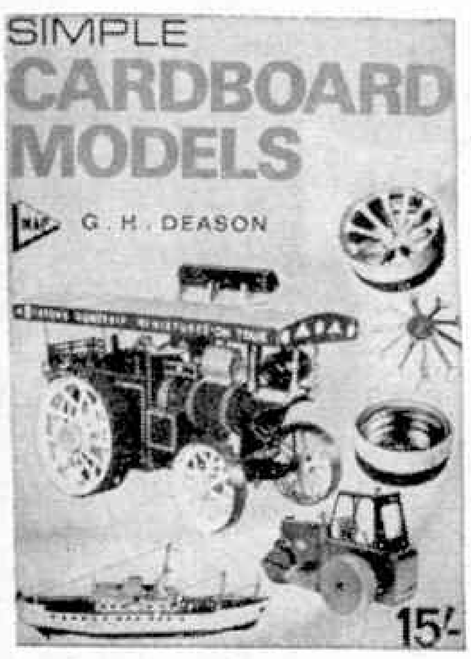

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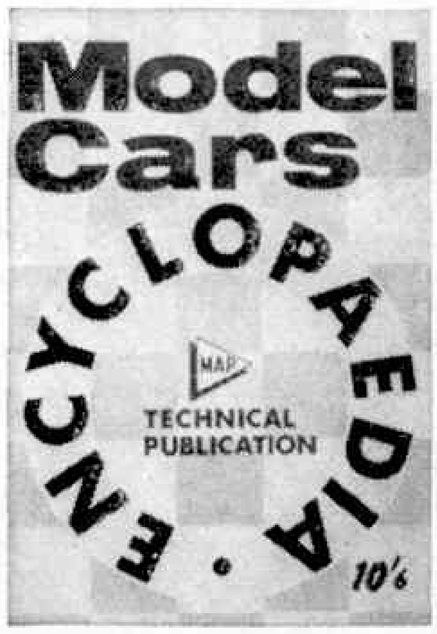

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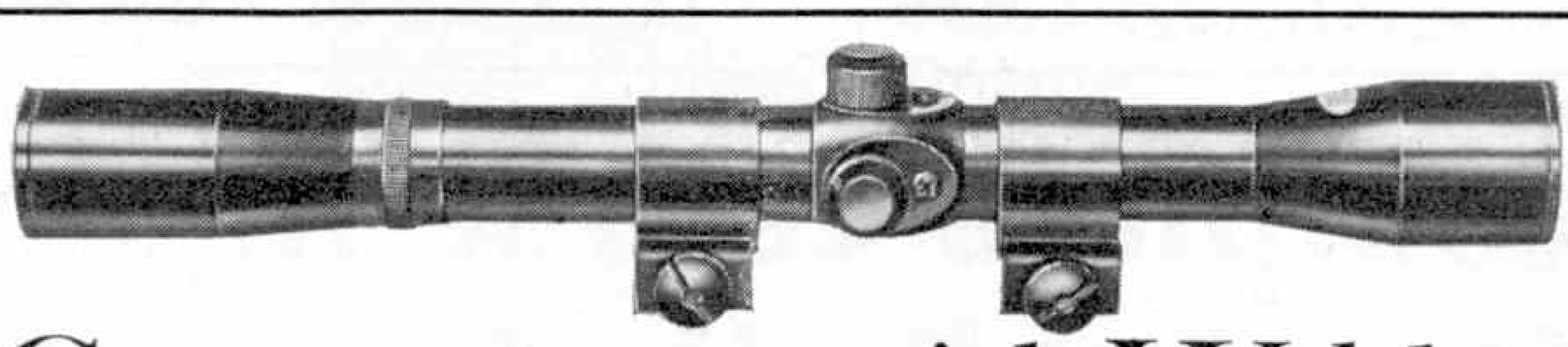

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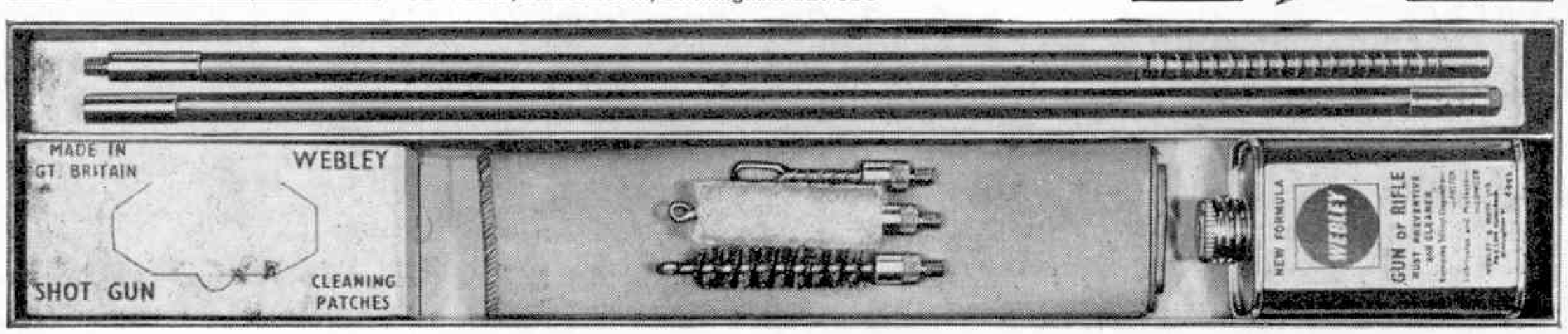
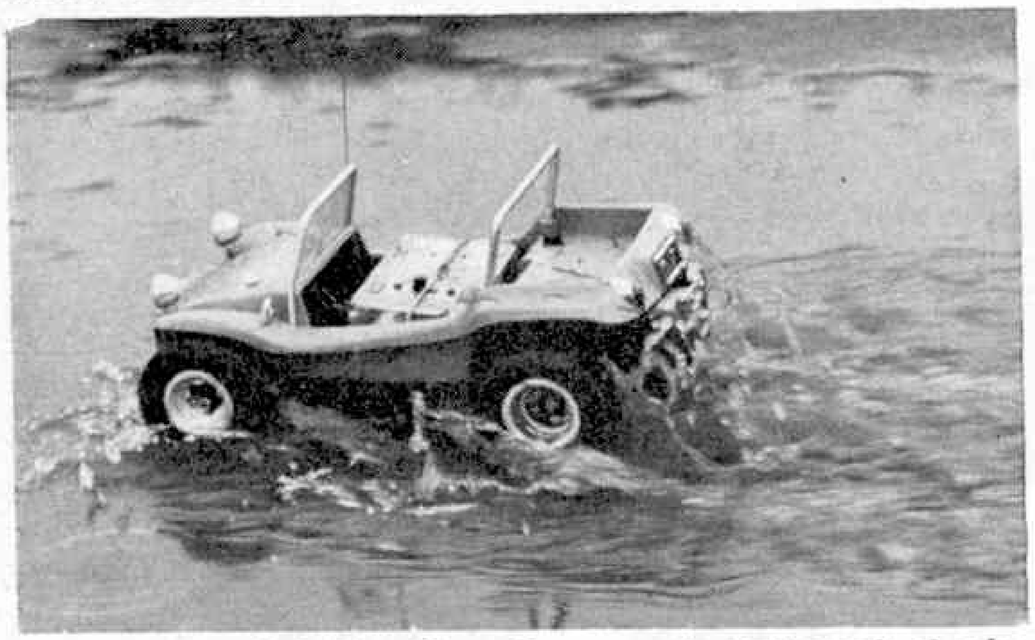


RADIO CONTROLLED DUNE BUGGY

A couple of weeks ago I spent a delightful morning operating a single-channel radio controlled "Beach Buggy" kindly loaned to our sister magazine 'Model Cars' by a reader. It measures 12 inches in overall length, is superbly finished in metallic purple plastic with plenty of chrome trim, and powered by a recoil start glo-plug engine of ¾ c.c. It is complete and ready to run ex-radio gear from the American firm of Cox and costs around £16. Incredibly low gearing (40: 1) gives it a top speed of only 5 m.p.h. which makes it ideal for the novice and virtually impossible to stall! A boon when it hits an obstacle. Unfortunately, existing stocks in this country are finished at the moment, but there is a possibility that A. A. Hales the importers may ship over a few more in the near future.



The smashing little Cox Dune Buggy made light work of rain-soaked earth and puddles on the path at our local park.

PRESS PLAY-IN

The lucky children of London's journalists were given a special treat when the toy showroom of the Lines Bros. group of companies was thrown open to members of the Press and their youngsters for a specially organised Press 'Play-In' on November 11th.

Special competitive games, involving the group's products, were devised and parents were asked to match

Press children building simple Meccano models in a contest at the recent Press 'Play-in.'

their skills against the youngsters, aged four to eleven. Presents were awarded to both children and adults in the form of £5 toy vouchers for the former and champagne for the latter, by Mr. Peter Thrower, managing director of Lines Bros. All children attending the 'Play-In' received gifts—Dinky Toys for the boys and Sindy Dolls for the girls.

RALLY ESCORT

Reader Kevin Saunders who specialises in modifying standard plastic car kits (I described a Morris 1300 G.T. he had drastically modified on this page last August) has been at it again! This time Kevin has turned his keen eyes on an Airfix Ford Escort and changed it into a fully-blown Works Rally Car. As you will see from the photograph below, re-working has been extensive and the finished result is in my opinion very good indeed. Externally various 'mods' have been effected such as flared wheel arches—'rally' type wheels—mudflaps—additional lights mounted on to a llama bar and finally all the transfers that identify this type of car as being something out of the ordinary. Modifications have also been effected inside the Escort with items such as anti-roll bars and conversion to left hand drive including a completely re-worked dashboard. Congratulations Kevin on yet another super model!

'Every inch a winner' is Kevin Saunders' latest plastic kit modification on an Airfix Ford Escort.

OUR MISTAKE

In last month's 'Have You Seen' we made a couple of quite serious mistakes, both unhappily concerning the same company's products. **Mainstream** were the victims of our errors and concern their model hovercraft and new Single Channel Radio outfit. Dealing firstly with the Hovercraft, we described the 'Mefa 11' a diesel operated model retailing at £1 but published a photograph of the PP1, an electrically powered job which retails at 16s.

Our second clanger concerns our review of the new radio gear—we described the 'Super-Het' equipment (retail price £28 15s. 0d.) but gave the prices of the Super-Regen (£22 6s. 0d.).

Our sincere apologies to Mainstream and any readers we misled through these mistakes.

DINKY TOY NEWS

by Alan Jones and Chris Jelley

TO THE HUMBLE OFFICE JUNIOR, the thought of jumping into an aeroplane and zooming off to a business meeting hundreds of miles away is something of a romantic dream, but, to top company executives, this is fast becoming a reality—an essential reality.

With the intense pressures and far-ranging nature of modern business, time and travel are vital to today's businessman and yet travel is likely to require the most time in today's world. The once-popular quick dash in a fast car is being made more and more difficult by increased traffic congestion on the roads, while the rapid train journey, in many cases, has been impossible by cut services and even abandoned routes. As a result, the businessman is turning to the air, but even here, the situation seems to be worsening. Air routes —particularly inside Britain—are still pretty sparse and the frequency of services on the routes available is far from outstanding—sometimes only one or two flights a day. As the number of passengers using air travel increases the difficulty of obtaining a seat on these flights naturally increases, unless advanced bookings are made, and how often can a company executive, suddenly called away on business, make a sufficiently far advanced booking ?

Heading photograph shows the new H.S. 125 " Executive " jet. Above: From the T.V. series " The Enchanted House", Tiny the Giraffe in his Mini-Moke. Opposite: The complete " Enchanted House" set

Faced with all these problems, what is the likely thing for the businessman to do ? Obviously to buy or charter his own aircraft or to make use of an air taxi company in preference to a regular airline.

In practice, of course, the individual businessman does not buy or charter, but more and more forward-thinking companies are certainly doing so. In fact, the potential market for comparatively small " Company 'Planes " is now so large that aircraft manufacturers are producing aircraft aimed specifically at this market and one of the most recent, most advanced and most successful examples is Britain's own Hawker Siddeley H.S.125 " Executive Jet ".

This distinctive little aircraft serves as the prototype for the first of this month's new Dinky releases, but, before looking at the Dinky, something must be said of the full-size original. To begin with, use of the word " little ", here, is perfectly in order: the 125 has a wingspan of only 47 ft. and a length of 47½ ft.—remarkably small by modern passenger jet standards.

Capable of seating anything from six people in absolute luxury, to 12 people in airline comfort, the cabin is also fitted with a bar and refreshment cabinets, individual reading lights and ventilating air supplies and " in-flight " accessible baggage holds and wardrobes. In addition, the cabin can be further furnished to the owner's taste in the way of carpeting, writing desks, tables, etc. Access to the aircraft is through a hinge-down door, immediately behind the cockpit, the inside of the door also incorporating the access steps, thus doing away with the need for a separate entrance/exit ladder.

Power for the aircraft is supplied by two Rolls-Royce Bristol Viper 522 turbojet engines in " pods ", mounted one each side of the rear fuselage section, each engine developing a thrust of 3,360 lb. Maximum cruising speed is 510 m.p.h. at 31,000 ft., the economic cruising speed being 450 m.p.h. at altitudes above 37,000 ft. The maximum range of the aircraft, with full fuel and payload, is 1,940 miles—a distance which, for such a small 'plane, is quite outstanding. Taking everything into account, therefore, it's easy to see why the H.S.125 Executive Jet is proving so popular with air-minded companies—and their executives !

And talking of popularity, this brings us straight to the Dinky Hawker Siddeley H.S.125 Executive Jet, Dinky Toy No. 723. Produced to 1/108th scale, this is a nicely-detailed reproduction capturing all the sleek lines of the original aircraft from its streamlined nose and fuselage, through its two rear-mounted engine pods to its swept-back fin and high tailplane. Special Dinky features include fully-glazed cockpit and cabin windows, plus an opening cabin door which, like the original, has steps formed in the inside surface so that, when the door is opened by hinging it downwards, it also serves as the access steps.

Fitted, in addition, is a working retractable undercarriage, hand-operated and laid out in the correct " tricycle " arrangement. Finish is in an eye-catching colour scheme of yellow wings and lower fuselage, white upper fuselage, fin and tailplane and metallic blue engines. A fluorescent red flash runs the length of the fuselage and engines at each side. Dinky Toys were pioneers of small-scale die-cast model aircraft way back in the 1930's; this new model proves that they still lead the field !

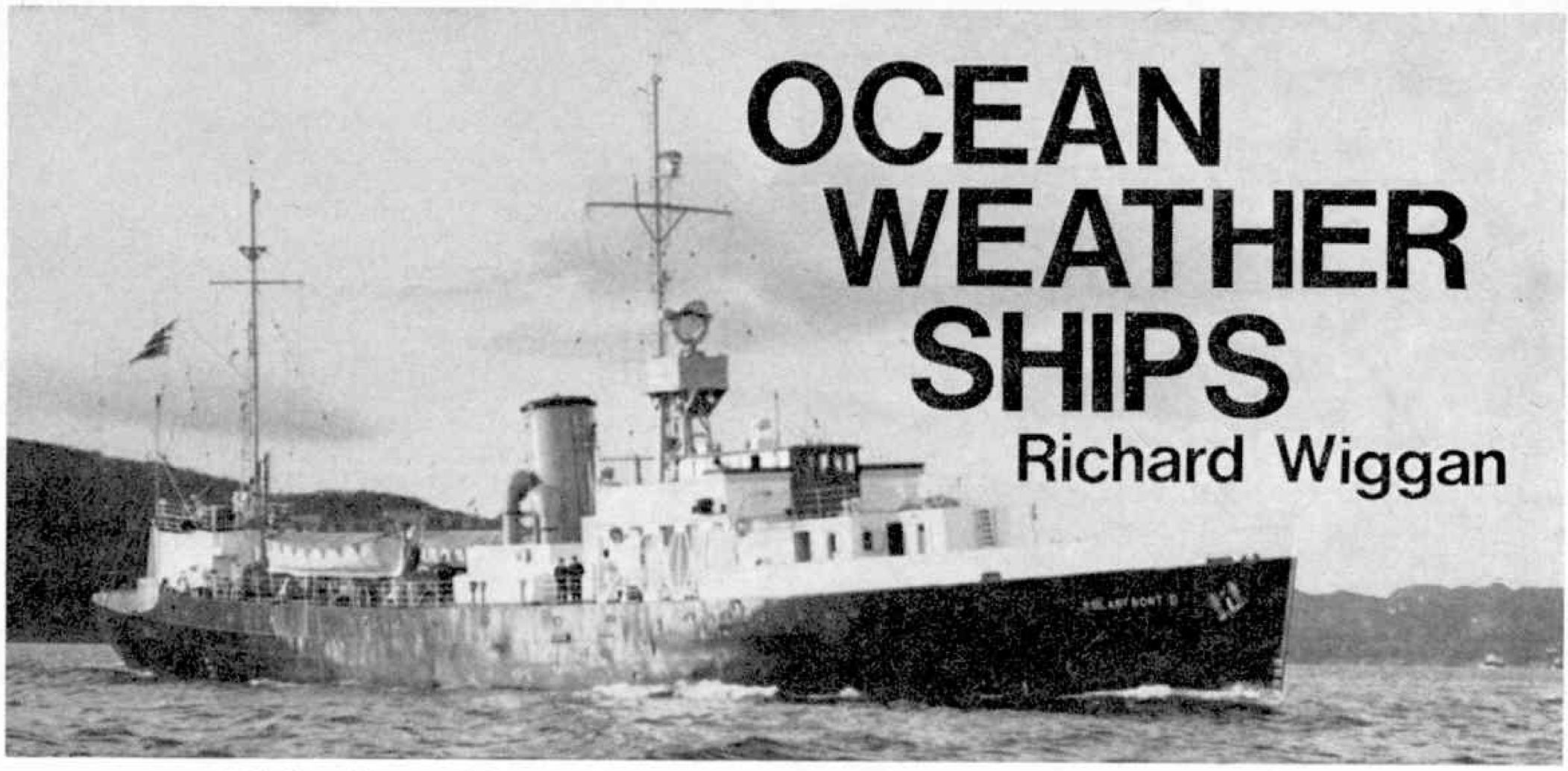
T.V. Favourite

Most models in the current Dinky Toy range are based on full-size originals, but released with the H.S.125 is a new model which owes its origin purely to fiction—television fiction, to be exact—Tiny's Mini Moke, Sales No. 350. Without any pretence, this colourful little model is aimed directly at the youngsters, many of whom will instantly recognise it as coming from the Independent Television's children's programme, " The Enchanted House ".

For those who haven't seen the programme, the series is basically about three captivating animals, Tiny the giraffe, Nellyphant the elephant and Joe the kangaroo who all live in a house together and whose animal friends come to visit them with their problems; problems which always seem to turn out right after their visit—hence the title of the show. For transportation, the animals use a gaily coloured Mini Moke, with Tiny as driver and you only need to think of a tall giraffe in relation to a small Mini Moke to realise that this can cause accommodation problems. In true cartoon fashion, however, the problem has been overcome by having a hole in the Moke's canopy, through which Tiny's head projects !

Dinky's version of Tiny's Mini Moke consists basically of the existing Dinky Moke and, as such, is fitted with an opening bonnet, covering a miniature transversely-mounted " engine ", a glazed windscreen, a steering wheel and a removable " soft-top " canopy. In Tiny's trim, however, instead of being finished in the original green colour with khaki canopy, it is painted in bright orange with a white-and-yellow striped hood and a white cover over the spare wheel at the back of the body. Even more important, a little model of Tiny, himself, sits tall and straight in the driver's seat with—sure enough—his head sticking through a hole in the canopy !

The Dinky Toy, alone, is enough to captivate every young (and not so young) child, but to further increase the fun, it comes complete with a set of cut-out cardboard figures including not only the Enchanted House, but also Tiny's fellow residents, Nellyphant and Joe, plus one of their many friends, Jock the Scots Terrier. In short, this is an " enchanting " (Oh!) new release which will be a smash hit with the children at whom it is aimed.



OCEAN WEATHER SHIPS

Richard Wiggan

Polarfront II—**one of the two Norwegian weather ships that form part of the international fleet.**
Reproduced by courtesy of the Royal Norwegian Embassy.

In all weathers throughout the year the men in the Ocean Weather Ship Service are on duty collecting data about the weather and relaying it to shore for Radio, Television and the Press . . . .

"MORE SNOW IS EXPECTED . . ." The words of the weather expert bring a chill feeling into the warmth of the lounge. Dad, with a lengthy car journey to work the following morning, wonders if the roads are blocked. His son thinks there may be a chance of fun in the snow.

Setting up tele-metering equipment prior to radio-sonde balloon ascent.

One thing is certain—the weather is going to be a more than usual topic of conversation the following day. But to men manning ships far out in the North Atlantic the weather is their chief interest. They serve in the Ocean Weather Ship service, collecting data about the weather that in a very short time is available to all of us through radio, television and the Press. Gathering this information is a well organised operation that has come a long way since those days before the World War Two when weather observations from the sea were provided almost entirely by voluntary observers in merchant vessels. Some were however provided by naval ships, a relatively small number.

Such observations, though valuable to the forecaster, are necessarily restricted in nature as they are of service conditions only and the ships are moving and are not often in the exact sport where the meteorologist needs them. As flights across the Atlantic of passenger and freight-carrying aircraft became a commercial possibility, it became apparent that more detailed information was necessary than could be obtained from voluntary observers in moving ships in order to provide meteorologists and aircraft with accurate information about weather conditions at sea, both on the surface

and in the upper atmosphere.

The French meteorological authorities in 1939 had a "stationary meteorological ship", the Carimare, making special meteorological observations in the North Atlantic, both at the surface and in the upper atmosphere. The Germans had the Ostmark operating in a similar manner in the South Atlantic in connection with their air routes to South America. The large number of aircraft being ferried across the Atlantic in the later stages of the war resulted in the Allied navies setting up a chain of naval "weather ships" in order to provide meteorological information by radio, since merchant vessels were unable to send radio messages for reasons of security. They were also afraid of giving away their position to lurking U-boats. Corvettes were used mostly for this work.

The coming of peace brought the realisation that the growth of air traffic would make the old pre-war system of weather observations by merchant ships inadequate. The World Meteorological Organisation and the International Civil Aviation Organisation agreed that it was essential to establish a chain of ocean weather ships in order to obtain data about the upper atmosphere. Weather ships could occupy fixed positions away from the normal shipping lanes. Accordingly an international conference was held in London in 1946 and 13 ocean weather stations were established. Three years later, the number was cut to ten for reasons of economy. Another conference was held in 1954 and the number further reduced to nine. The international aspect of this vital work is shown by the fact that all those countries whose aircraft regularly fly the North Atlantic route have signed the weather ship agreement and all contribute to it, either by providing ships or by contributing money.

The United Kingdom provides 4 vessels for the weather ship "fleet", France 2, the Netherlands 2, Norway and Sweden jointly 2 and the United States 11. The stations are Alfa, Bravo, Charlie, Delta, Echo, India, Juliett, Kilo and Mike. Britain's weather ships, which operate under the jurisdiction of the Meteorological Office, are based at Greenock, on the Clyde, and are ex-Castle class frigates, 250-ft. in length and of 1,800 tons loaded displacement. They are single screw vessels powered by a reciprocating oil-fired steam engine.

The crews are drawn mainly from the Merchant Navy, though a few are ex-Royal Navy who have been attracted to the weather ship service. The weather information is gathered by the seven professional meteorologists carried by each ship. They are responsible for making both surface and upper air observations The meteorologists are all volunteers and many have served for long periods in the ships. Their tour of duty is 12 months. This can be extended if they wish.

When the ship is "on station", surface meteorological observations are made every hour throughout the 24. These are similar to those which a merchant vessel makes every six hours. The observations take the form of cloud amount; wind direction and force; visibility, present and past weather; barometric pressure and tendency; air temperature and humidity; sea temperature; cloud height and cloud types; direction; height and period of waves. Surface observations are reported every three hours during passage to and from station.

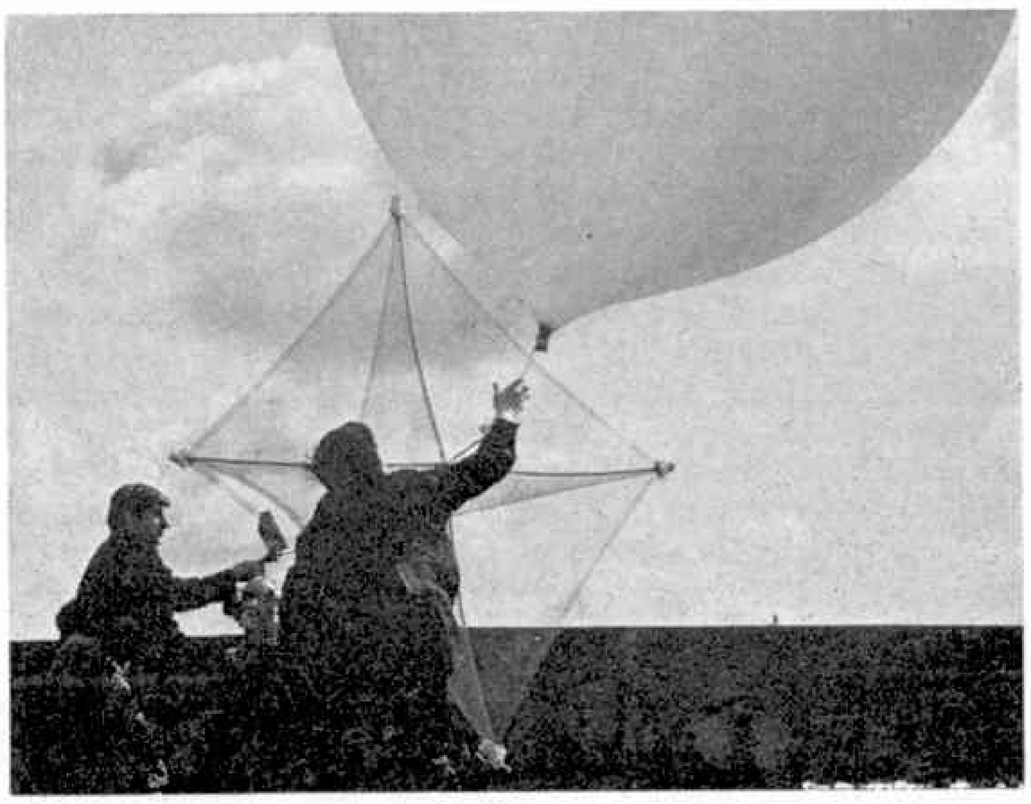
What is known as upper wind observation (radar wind) is made every 6 hours, while observations of temperature, humidity and pressure in the upper atmosphere (radio sonde) are made every 12 hours. For the upper atmosphere observations, a balloon is filled with hydrogen and when fully inflated is about

Tying the radio sonde transmitting unit to bottom of radar reflecting target.

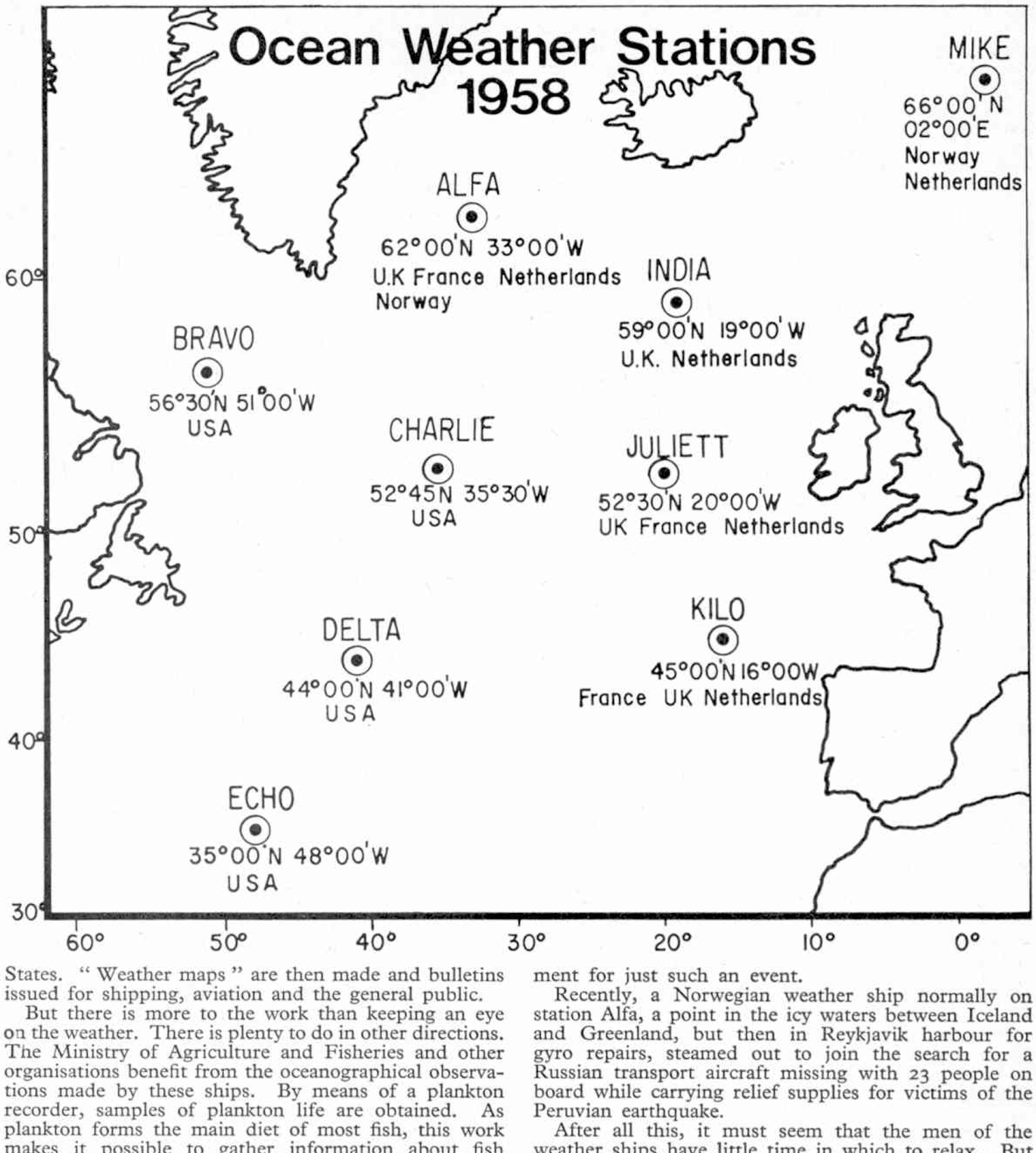
seven feet in diameter and rises through the atmosphere at more than 1,000 feet a minute. The radio sonde attached to it is actually a miniature transmitter. By an intricate arrangement of switches, controlled by a tiny windmill, it sends out signals of varying frequencies indicating the temperature, humidity and pressure as it rises through the atmosphere. The signals, once received aboard ship, are converted by means of an oscilliscope into values of pressure, temperature and humidity.

In the case of wind observations, the ship's radar apparatus tracks a radar target attached to the balloon as it rises through the atmosphere. Meteorologists are then able to calculate the wind speed and direction at the different levels. But making observations is not as easy as on land. The rise and fall of the ship in a heavy swell or when the vessel is being buffeted by heavy seas, makes handling the 7-ft. balloon anything but simple. Yet for all this it is rare indeed for the meteorologists to fail to get the balloon away.

The observations are coded in a special "figure" code and sent by radio direct to the Central Forecasting Office at Bracknell, Berkshire. Messages are plotted on a big map at the Meteorological Office, along with reports from meteorological stations ashore, both in the United Kingdom and abroad, including the United



Releasing the radio sonde balloon.



States. " Weather maps " are then made and bulletins issued for shipping, aviation and the general public.

But there is more to the work than keeping an eye on the weather. There is plenty to do in other directions. The Ministry of Agriculture and Fisheries and other organisations benefit from the oceanographical observations made by these ships. By means of a plankton recorder, samples of plankton life are obtained. As plankton forms the main diet of most fish, this work makes it possible to gather information about fish movement. These data are of special value to deep-sea trawlers. The weather ships also get really close to their subject in this aspect of their work by casting a line. One vessel's " bag " comprised three sharks caught within the space of two days. Another time, a ship caught more than 30 fish in one day.

This day-to-day routine work may suddenly be interrupted by an emergency. More than one weather ship has figured in air-sea rescue operations. A weather ship is put on the alert if an aircraft or ship in the area is in difficulties. An aircraft can " ditch " alongside a weather ship, which carries special rescue equipment for just such an event.

Recently, a Norwegian weather ship normally on station Alfa, a point in the icy waters between Iceland and Greenland, but then in Reykjavik harbour for gyro repairs, steamed out to join the search for a Russian transport aircraft missing with 23 people on board while carrying relief supplies for victims of the Peruvian earthquake.

After all this, it must seem that the men of the weather ships have little time in which to relax. But they do relax during their 24 days " on station ". Cinema shows are a favourite, while games of darts or cards are a firm choice with others. Long spells at sea provide opportunities for catching up on one's reading, and in this respect each vessel has a good library. Books and magazines are always welcome. These can be sent to: Ocean Weather Ship Base, Great Harbour, Greenock, Scotland.

The days " on station " pass, until the relief ship is spotted on the horizon and it is time to head for home and a well-earned rest before once more braving the North Atlantic to learn about—the weather!

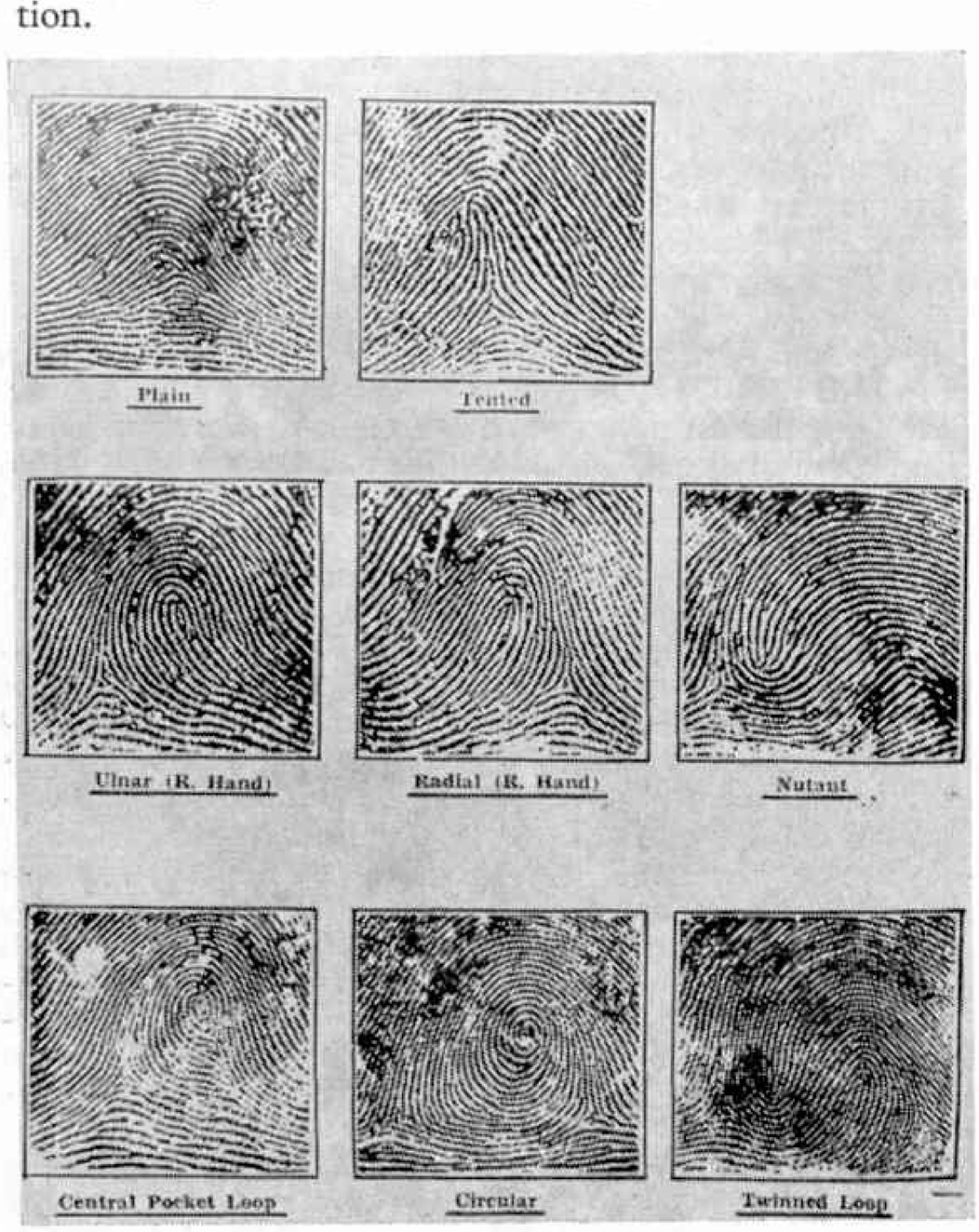
'SIXTEEN POINTS OF GUILT'

(The story of fingerprints)

by Peter Wilkes

WHEN, ON A WET MONDAY MORNING IN MARCH, 1905, Chief Inspector Fox hurried with detectives to a Chandler's shop in Deptford High Street, to investigate the murder of the manager and his wife, he could little have realised that his investigations were to make legal history. Yet, such was the case for the only clue found by the police in their search of the premises was a solitary thumb print on a ransacked cash box.

Today the finding of such evidence would, in all probability, mean the speedy end of the investigation. A photograph of the fingerprint would be rushed to the Fingerprint Department at Scotland Yard, where experts, if the criminal had previously been convicted, could, with speed and certainty, identify the offender. Further more, the detective in charge of the case would know that his fingerprint evidence would be accepted by the courts as infallible proof of identification.



Enlarged photograph of the basic fingerprint patterns. From this it is easy to see the distinct differences in the ridge patterns of the respective fingerprints.

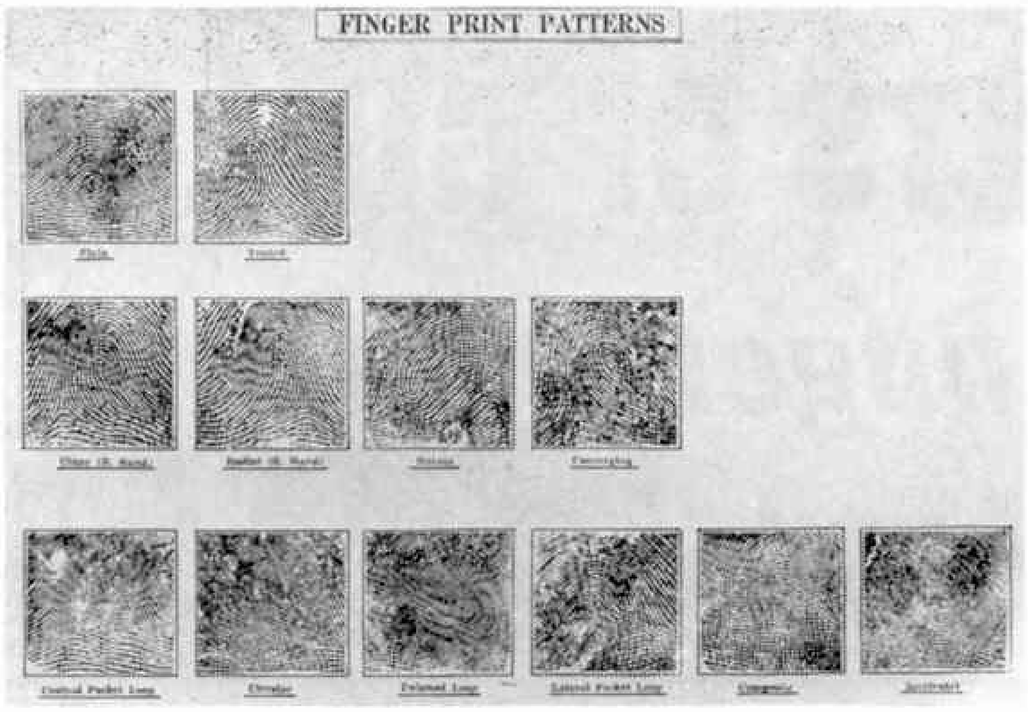
Chief Inspector Fox, in 1905, had no such aids to turn to. The Fingerprint Department was in its infancy, and the number of criminals whose 'prints' were on record was small. Even when, after long hours of patient enquiries, suspicion fell on two brothers, Albert and Alfred Stratton, and it was discovered that the thumb print on the cash box was identical with Alfred's right thumb print, his troubles were not over. Never, in a major case before the English courts, had fingerprints been relied upon exclusively. Could a conviction be obtained solely on such evidence? The prosecution was entrusted to Sir Richard Muir, who made himself thoroughly familiar with this new science. As well as demonstrating the eleven points of similarity found between the 'prints' by means of large sketches on a blackboard, he arranged for Detective Sergeant Collins from the new Fingerprint Department at Scotland Yard to take the fingerprints of members of the jury to prove the infallibility of the system and the method used to prove the differences. So thorough was Sir Richard Muir, in presenting and explaining this new evidence, that the judge, Mr. Justice Channell, himself a sceptic of the science, admitted, in his summing up to the jury, the extraordinary resemblance between the two thumb prints and the improbability of two people having the same fingerprints. After this the verdict was a mere formality and both the brothers were hanged for their crimes.

Today fingerprints are an accepted part of scientific criminology, and Scotland Yard alone, since the Stratton case, has identified over one million criminals

HENRY PRIMARY CLASSIFICATION

1. Right Thumb	2. Right Forefinger	3. Right Middle finger	4. Right Ring finger	5. Right Little finger
16D	16N	8D	8N	4D
1. Left Thumb	**2. Left Forefinger**	**3. Left Middle finger**	**4. Left Ring finger**	**5. Left Little finger**
4N	2D	2N	1D	1N

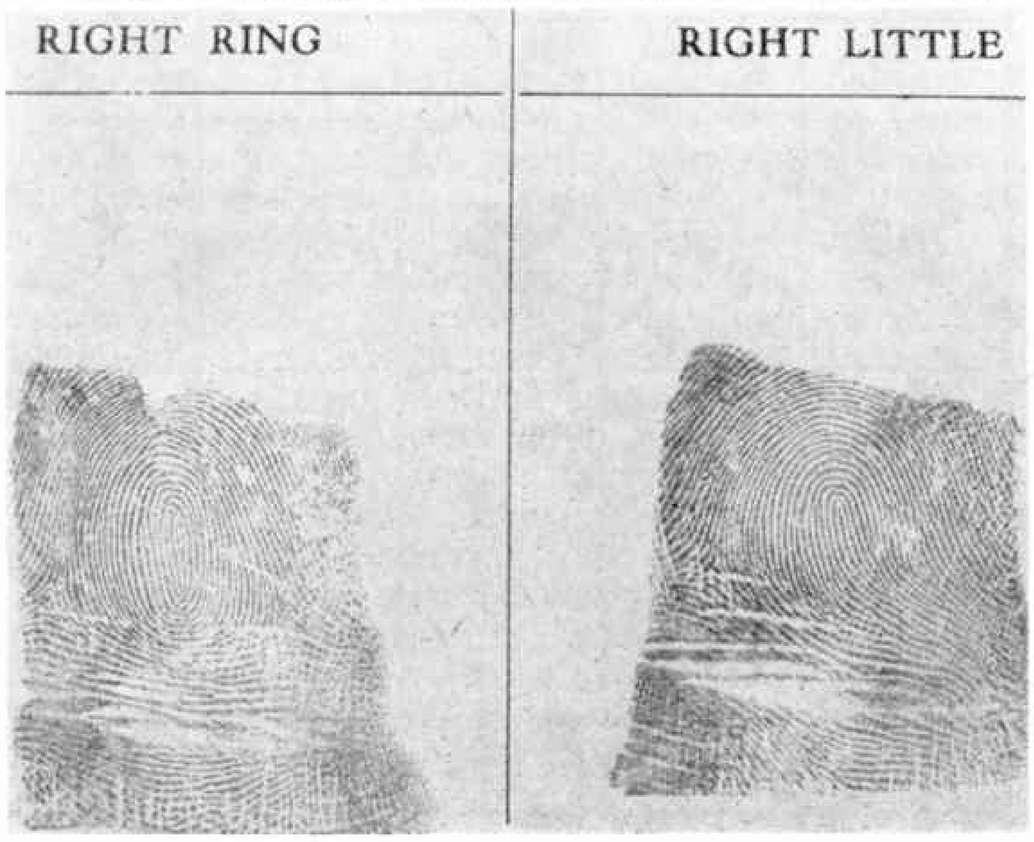
NUMERICAL VALUES : 'D' DENOMINATOR 'N' NUMERATOR



Fingerprint Patterns. The top line shows ARCHES and the sub classification into which they are divided. The centre line shows LOOPS and their sub classifications and the bottom line, WHORLS and their sub classifications.

through their Fingerprint Department. Yet, strange to relate, the early story of identification by fingerprints does not belong to the police, for the first suggestion of their possible use in criminology came from Dr. Henry Faulds, a missionary-doctor working in Japan. His interest began when he noticed differences in the finger patterns left by potters on fragments of old pottery. Faulds made an intensive study of the subject and even tried to alter the patterns by removing skin from the finger tips. In each case he found that, when the fingers healed, the same impressions returned. By chance Faulds became involved in a criminal case where the culprit had left sooty fingermarks on a wall. He was able to prove the innocence of one man arrested by the police for the offence and the guilt of another. After this he became so convinced of the merits of fingerprints for identification, that in 1880, he wrote a letter to the scientific publication. " Nature ", giving the results of his work. He even suggested a register of criminal fingerprints be kept and impressions found at the scenes of crime compared with those in the register. His letter to " Nature " put him in touch with Sir William Herscel who, like Sir Francis Galton,

Fingerprints as taken by the Police. These are " rolled " impressions and are obtained by rolling the inked finger from side to side across the fingerprint form, as distinct from taking " dabs "—impressions obtained by pressing the finger tips direct onto paper. For criminal investigation examination, " rolled " impressons are always taken from a prisoner.



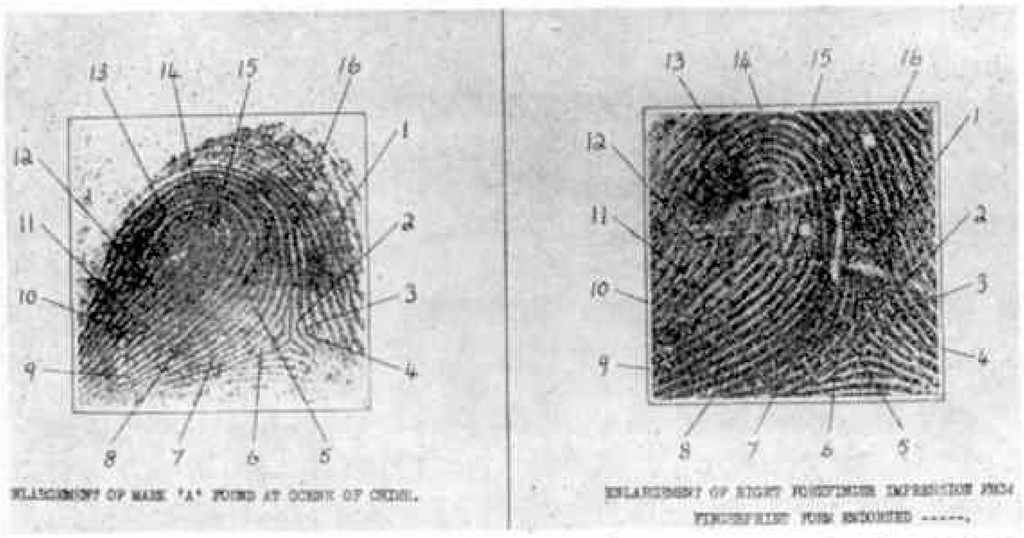
a cousin of Charles Darwin, had been doing similar experiments. These early pioneers all agreed on the infallibility of fingerprints as a positive method of identification and were able to show that this was possible because of unique properties of the skin found on the hands and soles of the feet. This differs in character to that on other parts of the body because it consists of numerous elevations of the skin surface which were given the name " ridges ". These ridges, subjected to close examination, were found to be made up of numerous microscopic pores, and it is these outlets for perspiration which cause an impression to be left whenever the hand or sole of the foot comes into direct contact with a surface. Unfortunately neither Dr. Faulds, Herscal or Galton could devise a system of fingerprint classification and their very individuality meant that, without classification, any collection would soon become too large to be workable.

The man who finally solved this problem and enabled fingerprints to be used in criminal investigations, was Sir Edward Henry, an Inspector of Prisons in Bengal and, from 1903, Commissioner of Police of the Metropolitan Force in London. Henry often said that the system, which even today forms the basis of classification in most fingerprint bureaux throughout the world, came to him during a train journey across India and, because he had no writing materials with him, he made notes on the cuffs of his shirt. Henry divided the patterns made by the ridges on the ends of the fingers into three main groups which he called, " Arches ", " Loops " and " Whorls ". By giving a numerical figure to any finger whose pattern was a " whorl ", he arrived at a primary classification of 1,024 types.

Illustration No. 3 shows the way that Henry's primary classification works in practice. If there are no whorls on any of the fingers or thumbs of either hand, a classification of 0/0 would be given but, to avoid " 0 " Henry added 1 to both numerator and denominator and hence, for no whorls, a classification of 1/1 is arrived at. A person who had " whorl " patterns on all fingers and thumbs would be classified under 32/32 (31 from the Henry numbers plus 1). The combination of numbers between 1/1 and 32/32 gives the 1,024 primary classifications under this system. The secondary classification into which the primary groups are divided depends on the variations of the ridge characteristics of the respective fingerprints. This basic system proved ideal for the grouping of the fingerprints of both hands and gave a means whereby the identity of any known criminal could be proved irrespective of an alias that he may take.

A development of this system, the Single Fingerprint collection, consists of the fingerprints of known criminals classified according to the ridge characteristics of each separate finger. It is to the Singles Collection that the fingerprint expert turns when a fingerprint is found at the scene of a crime. If the person responsible has a criminal record, he is soon able to inform the investigating detective of the identity of the culprit. Should it be that the mark has been left by a person whose fingerprints are not recorded, the mark from the scene of the crime is filed in the Singles Collection until such time as the offender comes into police custody. Immediately his fingerprints are received in the department, a check is made on unidentified marks from scenes of crime and detectives are informed of any offences he may have committed.

At a Conference in 1953, it was decided, in order to bring uniformity to fingerprint evidence, and to be able to prove, beyond any shadow of doubt, the infallibility of the system, that, when fingerprint evidence is given in court, 16 points of similarity shall be proved



Showing how a fingerprint is proved in court. On the left is enlarged photograph of the fingerprint found at the scene of the crime and on the right the fingerprint taken from accused person. The sixteen points of similarity are marked on the photographs.

between the fingerprint found at the scene of the crime and that of the suspected person. In practice this is done by having enlarged photographs of the two fingerprints marked showing the 16 differences in ridge characteristics that are common to both. The experts have calculated that, if the 16 points of similarity are proved, then the chances of the impression having been made by a person other than the accused are 4,300,000,000 to 1.

The greatest triumph in the story of fingerprints must, without doubt, be the case of Peter Griffiths, the 22 year old, ex-guardsman, who, on the 19th November, 1948, was hanged at Walton Prison, Liverpool, for the murder of four year old June Anne Devaney, who he took from a cot in the Queens Park Hospital at Blackburn, on the 15th May, 1948. The only clue found by the police at the hospital was a Winchester bottle containing a perfect set of fingerprints. Enquiries were made by the detectives and every member of the hospital staff who could have handled the bottle during their duties were fingerprinted. When the police found that none of these fingerprints were identical with those on the bottle, they knew they had in their possession the fingerprints of the murderer. The man in charge of the investigation was Detective Inspector John Capstick from Scotland Yard and he took the unprecedent step of arranging that all males over the age of 16 years, who been in Blackburn on the night of the murder should be fingerprinted. When it is realised that the population of the town was then 110,000, the size of the task facing the police can be fully appreciated. After three months of hard work by detectives working in teams and each responsible for one particular area of the town, the task appeared to have been completed without the discovery of the criminal. It was then decided to make a check of the lists in the possession of the police against the ration cards, then in force in England, to see if any one had been omitted from this initial fingerprinting. As a result a further 800 names were supplied to the detectives and this time they were successful. Among the fingerprints obtained were those of Peter Griffiths—the hunt was over. As the prosecution prepared their case against Griffiths, Inspector Capstick must have offered his thanks to Inspector Fox and those pioneers of 1905 whose work and endeavour had done so much to bring fingerprints within the realm of criminology and made the case against Peter Griffiths possible.

TALKING TOOTH *by M. Lorant*

DR. MAJOR M. ASH, PROFESSOR OF DENTISTRY and Ian S. Scott, project engineer, University of Michigan's School of Dentistry, have developed the most sophisticated and 'garrulous' tooth in the world.

Packed with six miniature transmitters, 28 electronic components with special bondings and two rechargeable batteries, the talking tooth looks like an ordinary "bridge" of a first molar. Inserted in a patient's mouth it can chew food, measure the pressures and directions of forces impinging on its surface, and broadcast detailed information to waiting monitors.

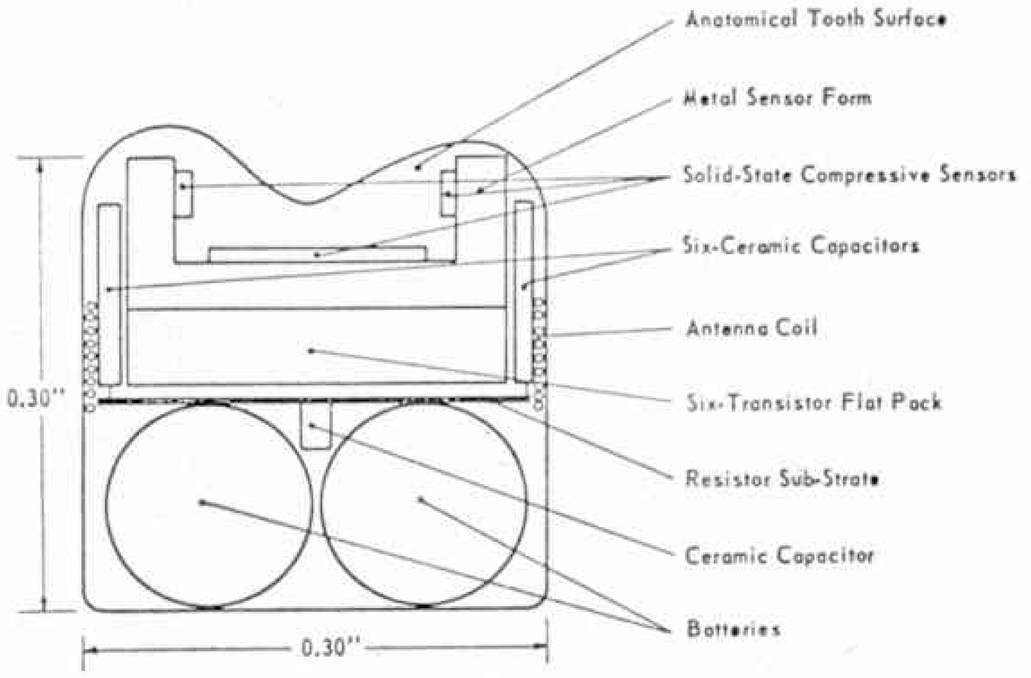
More than two years of complicated planning and assembly have gone into the tooth transmitters. The University of Michigan researchers, supported in their work by grants from the U.S. National Institutes of Health, had to develop a number of refinements in miniaturisation, telemetry and solid state physics before they could bring the concept into reality.

They reported on their work at the International Association for Dental Research meeting in Toronto, Canada, and revealed that the tooth was first used when it was inserted as a replacement upper first molar in the mouth of a volunteer. While the volunteer proceeded to eat various foods, the tell-tale tooth broadcast a stream of information revealing the play of forces across its surface.

Information broadcast by the electronic denture is received and recorded by six telemetering devices in the laboratory. Broadcasting range of the talking tooth is quite limited, so all tests must now be performed in the laboratory, but plans are being developed for a vest-pocket booster apparatus which will transmit the signals over a distance of several miles.

Previous efforts to study the forces exerted on a tooth have been thwarted, according to the researchers, because any instruments inserted into the mouth make the bite abnormal. Even if one touches the face, muscle co-ordination is thrown off. Natural teeth have a protective system which guards against tooth damage by causing muscle adjustments of jaw movements and modifications of occlusal forces.

As the electronic denture divulges and accumulates evidence it should provide a greater understanding of nature's own protective system and its relations to muscular function, periodontal disease and the basic neuromuscular mechanism involved in jaw positions and movements. It also should eventually give dentists better guides for restoring teeth which have been damaged.



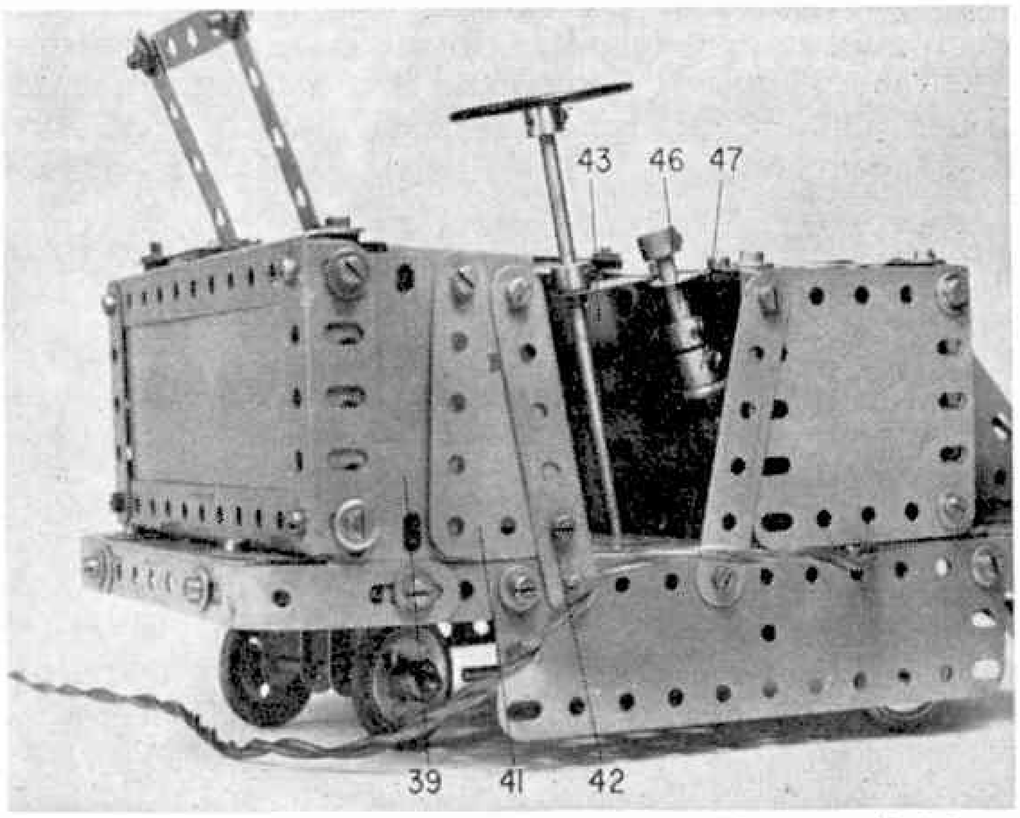
A WORKING PLATFORM SWEEPER IN MECCANO

An unusual and interesting model for Meccano builders described by SPANNER — Conclusion

Steering

At this stage the rear, steerable wheels and the steering linkage should be added. A 2 in. Strip 19, overlayed by a Double Arm Crank, is bolted between the centre of Angle Girder 5 and Flat Plate 2. Journalled, free, in the boss of the Double Arm Crank is a 2 in. Rod, held in place by a Collar above the Crank and by another Double Arm Crank below the Strip. This second Double Arm Crank is bolted to a 2½ in. Strip 20, the securing Bolts also fixing two 1 in. Double Brackets 21 to the underside of the Strip. Incidentally, please note that the Strip projects two holes beyond one end of the arm of the Crank. Journalled in the end holes in the lugs of the Double Brackets is a 2½ in. Rod, on which two 1 in. loose Pulleys 22, fitted with Rubber Rings, are held by Collars. Each Pulley is spaced from the nearby Double Bracket by two Washers.

Lock-nutted through the second hole in the protruding end of Strip 20 is a shaped 3 in. Narrow Strip, the other end of which is lock-nutted to the arm of a further Double Arm Crank 23, fixed on the lower end of a 4½ in. Rod 24, forming the steering column. This Rod is mounted in one hole in Flat Plate 2 and will also later be mounted in 1½ in. Strip bolted to the body.



With the model completed, the E15R Motor is controlled from the cab by means of a short extension lever connected to the Motor switch.

Bodywork

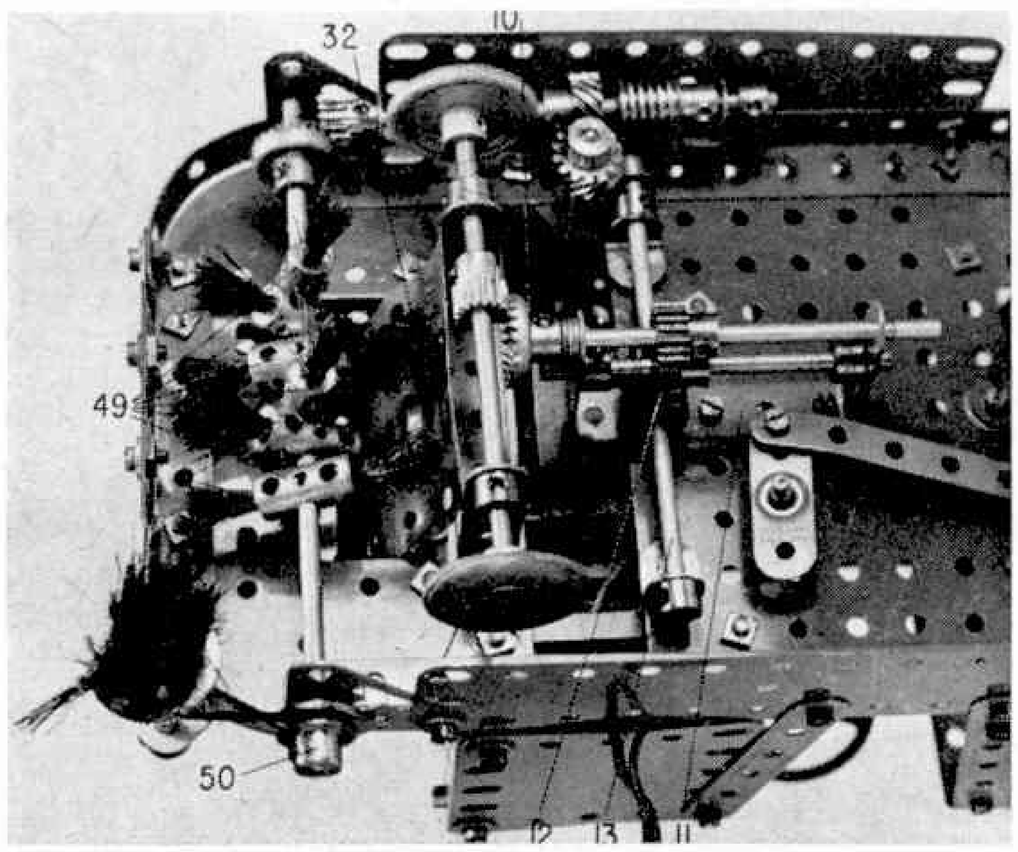
The bodywork, itself, is fairly straightforward. Two vertically-mounted 2½ in. Angle Girders 25 are bolted, one to each end of Angle Girder 5, at the same time fixing a 5½ × 2½ in. Flexible Plate 26 in position. The upper ends of Girders 25 are joined by a 5½ in. Angle Girder 27. Two further vertically-mounted 2½ in. Angle Girders 28 are fixed by Angle Brackets, one to each end of Flat Girder 3, then a 6½ in. compound flexible plate 29 is bolted between left-hand Girders 25 and 28, the compound plate consisting of one 5½ × 2½ in. and one 2½ × 2½ in. Flexible Plate, overlapped three holes. The compound plate is edged along the top by another 5½ in. Angle Girder 30.

Towards the front of the models, two Obtuse Angle Brackets and two 2½ in. Angle Girders 31 are bolted to the top of Flat Plate 3, the Angle Brackets spaced by a distance of three holes and the Girders by a distance of five holes. Secured through its second holes to the free lugs of the Obtuse Angle Brackets is a 2½ × 2½ in. Curved Plate 32 which projects downwards to form a back plate for the sweeping-brush "compartment", while bolted to the spare flange of each 2½ in. Girder is a 2½ × 2½ in. Triangular Flexible Plate 33. A 5½ × 2½ in. compound flexible plate 34,

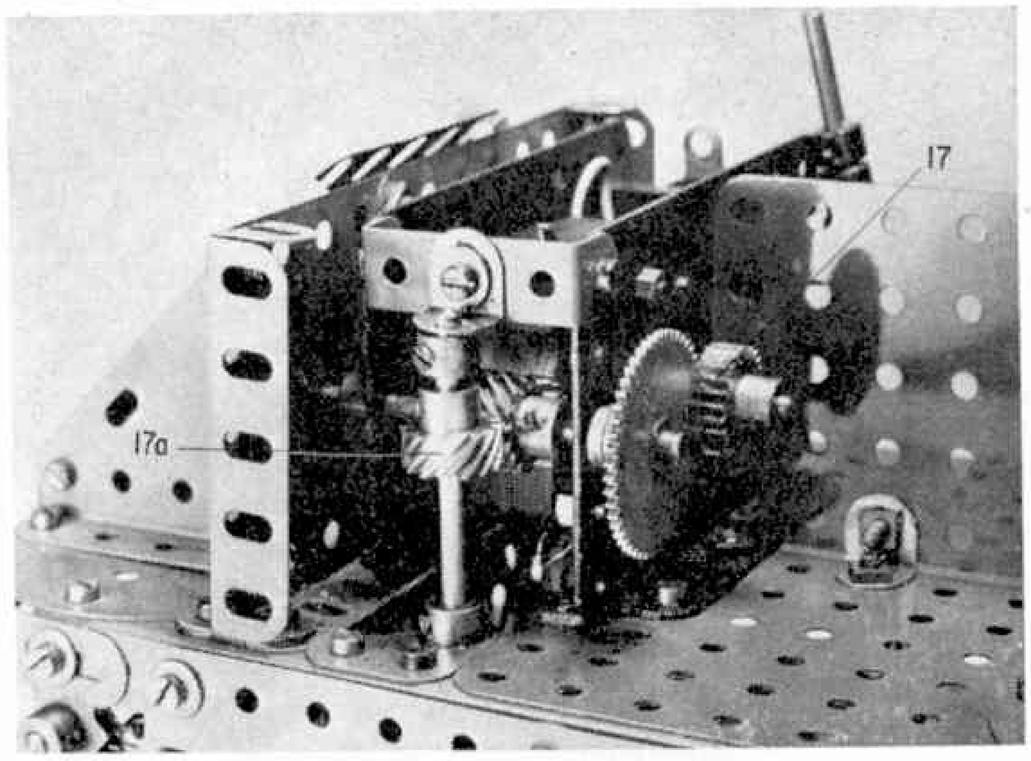
obtained from one $3\frac{1}{2} \times 2\frac{1}{2}$ in. and one $2\frac{1}{2} \times 2\frac{1}{2}$ in. Flexible Plate, is then bolted between Angle Girders 28 at each side, the two upper securing Bolts each holding an Angle Bracket in place, after which a $4\frac{1}{2} \times 2\frac{1}{2}$ in. Flexible Plate 35 is fixed to Angle Girder 7, being bent back to follow the slope of Triangular Flexible Plates 33.

At the right-hand side of the model, a $2\frac{1}{2} \times 2\frac{1}{2}$ in. Flexible Plate 36 is bolted to Angle Girder 28, a 3 in. Strip 37 and an Angle Bracket being bolted to the upper rear corner of this Plate. The Strip is angled, as shown, and the lower end bolted to Flexible Plate 9, whereas a $5\frac{1}{2} \times 2\frac{1}{2}$ in. Flexible Plate 38 is bolted to the spare lug of the Angle Bracket, this Plate also being fixed to the two Angle Brackets held by the upper Bolts securing compound plate 34 to Girders 28, as well as to Angle Girder 30. A $2\frac{1}{2} \times 1\frac{1}{2}$ in. Flexible Plate 39 is bolted to right-hand Angle Girder 25, a $2\frac{1}{2} \times 1\frac{1}{2}$ in. Flanged Plate 40 and a $2\frac{1}{2} \times 1\frac{1}{2}$ in. Triangular Flexible Plate 41 in turn being fixed to Plate 39, as shown. The right-hand flange of Flanged Plate 40 is connected to Flexible Plate 9 by a 3 in. Strip 42, while bolted to the left-hand flange is a $4\frac{1}{2} \times 2\frac{1}{2}$ in. Flat Plate 43, this Plate also being attached to Angle Girder 27 by an Angle Bracket. Two Bolts 44, shanks pointing upwards, are held by Nuts in Angle Girder 27, another two corresponding Bolts being held in Flexible Plate 38. Located on these Bolts, and held in place by further Nuts, is a $4\frac{1}{2} \times 2\frac{1}{2}$ in. Flat Plate 45.

Fixed to Flexible Plate 38 in the positions shown are a $1\frac{1}{2}$ in. Strip and a Fishplate, both bent to a very slight obtuse angle. The Strip serves as the upper journal for the steering column, a Collar above the Strip holding the column in place. A $1\frac{3}{4}$ in. Steering Wheel is mounted on the end of the steering column. The Fishplate serves as the journal for a $1\frac{1}{2}$ in. Rod 46, on the end of which an End Bearing 47 is mounted, the arms of the End Bearing being lock-nutted to one arm of the E15R Motor control switch. The Rod of course slides in the Fishplate to actuate the switch, "stops" consequently being provided by two Collars fixed on the Rod. A back for the driver's seat comes in the form of two $2\frac{1}{2}$ in. Narrow Strips 48, the lower ends of which are bent and bolted to Angle Girder 27, while the upper ends are joined by another $2\frac{1}{2}$ in. Narrow Strip.



A close-up view of the drive to the sweeping brushes and the sweeping brushes, themselves.



Motive power for the Platform Sweeper comes from a Meccano E15R Electric Motor, normally hidden from view, but illustrated here to aid construction of the initial drive system.

Sweeping brushes

Everything else having been completed, the sweeping brush assemblies can now be built up and fitted. Two assemblies are included, a main centre-positioned assembly and a smaller side assembly, the bristles for both of which are approximately 2 in. long and cut from a stiff paintbrush, being formed into a number of smaller brushes by the simple expedient of folding groups of 2 in. bristles in half to make 1 in. "brushes" and then by sticking the folded ends together by dipping them into glue. While the glue is still wet, the resulting "brushes" should be positioned in their holders to ensure that the bristles remain in position. The holders in the case of the main assembly consist of six Couplings 49 mounted at varying angles on a $6\frac{1}{2}$ in. Rod journalled in Corner Brackets 8 and held in place by a Collar and a $\frac{1}{2}$ in. fixed Pulley 50. Also fixed on the Rod is a $\frac{3}{4}$ in. Contrate Wheel which meshes with Pinion 15. Two "brushes" are fixed, one in each end of each Coupling, as shown.

The brush holder in the case of the small side assembly is an electrical 1 in. Bush Wheel 51 mounted on the lower end of a $1\frac{1}{2}$ in. Rod held by Collars in a Double Bracket bolted to the right-hand Formed Slotted Strip of the chassis. Six brushes are fixed, one in each hole in the face of the Bush Wheel, the complete assembly finally being driven by a $2\frac{1}{2}$ in. Driving Band passed round the lower Collar on the Rod and around Pulley 50.

PARTS REQUIRED

2—4	3—26	1—154b
1—5	2—26c	1—154b
1—6	1—27	4—155
1—6a	2—29	1—166
2—8b	2—32	1—185
3—9	124—37a	1—186
1—9b	102—37b	2—188
4—9d	33—38	2—189
1—11	2—47	4—190
2—11a	1—48	1—190a
10—12	1—51	1—191
1—14	1—52a	2—192
1—15	2—53a	4—211a
2—15a	20—59	4—214
1—16	3—62b	4—215
2—16a	6—63	1—221
2—16b	2—103	2—223
2—18a	1—103c	3—235
2—22	2—111a	1—235a
2—22a	6—111c	1—518
1—23a	2—133	
1—25	1—133a	1—E15R Motor

MILLER'S WORKSHOPS

by Edyth Harper

photographs by Robert Bristow

Believed to have originated in Holland, smock mills such as this example at Histon (Cambs.) are said to have been so named due to an appearance similar to that of a figure wearing a smock coat.

"HE WHO OWNS THE LAND WHEREON A WINDMILL STANDS owns the wind above that land to the extent of the extreme boundaries of his estate, North, South, East and West."

That was the law quoted in a dispute which took place in the 12th century. A man living on glebe land at Haberden in 1191 put up a mill in order to grind his own corn. The Abbot who owned the land took exception to this and ordered his tenant to pull down the mill, claiming that not even a King could erect a mill on someone else's land.

When Doomesday Book was compiled there were about 6,000 mills in Britain, but these were water-mills. Today about 100 windmills still stand. It is interesting that in the North and West, most mills were worked by water power, but in the South millers preferred sails worked by the wind to grind their corn.

Mills worked by the wind only became popular about the time of the Crusades. In fact, some authorities claim that the idea of wind-power to turn the grind-stones originated in the East and was introduced into Britain in the 12th century by returning Crusaders. No doubt local opposition to innovation was as strong then as it is today but, gradually, men realised the benefits of harnessing the wind ashore as well as afloat and windmills came to stay.

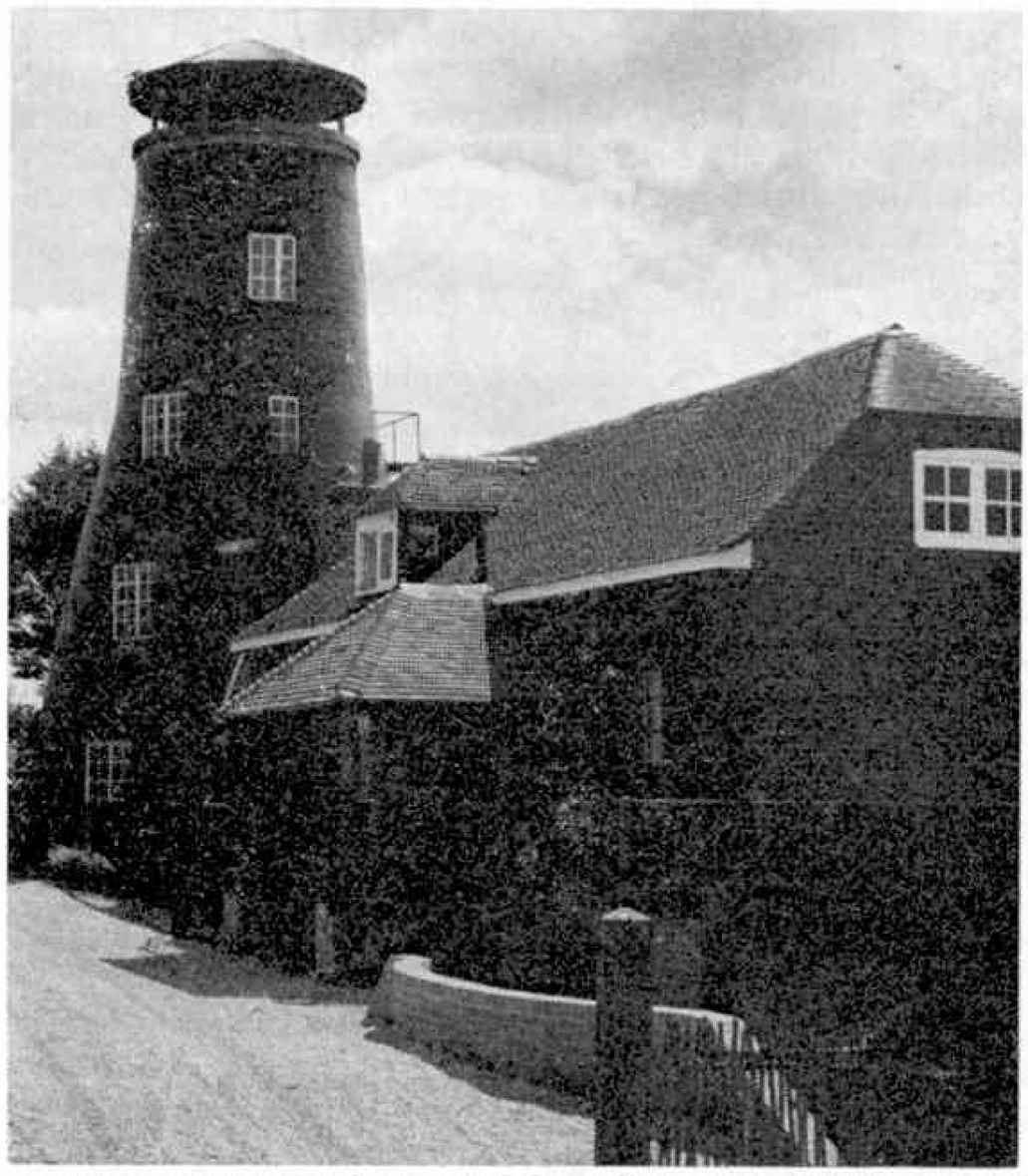
Somerset's last working windmill, Ashton Mill, stands at Chapel Allerton. It ceased its working life in 1927, but was restored in 1958, to stand in a $2\frac{1}{2}$ acre field, a monument to centuries of rural industry.

Among the oldest mills are Pitstone Mill, the mill at Brill in Buckinghamshire and the Bourer mill, Cambridgeshire. Pitstone (known as Pichelstone in the 13th century) has a well preserved mill contrasting vividly with modern cement works nearby. It is thought to date from 1627 while the windmill at Brill was put up in 1668. The Bourn mill was working in 1636. The oldest working mill can be seen at Outwood, Surrey. Its sails have been turning since 1665. If you want to see the highest mill go to Hurtwood (812 ft.).

The nearest mill to London can be seen at Wimbledon. The windmill, rebuilt in 1893 to replace one erected in 1817, was known to Baden-Powell, who wrote "Scouting for Boys" while staying there in 1907-8. Another author, Nevil Shute, wrote some of his books while staying in Langstone Mill, near Havant.

Many old mills have been preserved for posterity. Cranbrook Mill, in Kent, built in 1814, was brought up to date in 1842. Known as a smock mill, its present fine condition is largely due to Dutch experts. Other well kept mills are at Heckington, near Sleaford, and Cross-in-Hand, Sussex. Those who care to join the Society for the Protection of Ancient Buildings can join in tours round Britain from mill to mill.

There is a charm about windmills that never fails to attract people to them and will continue to do so as long as they remain in our midst.



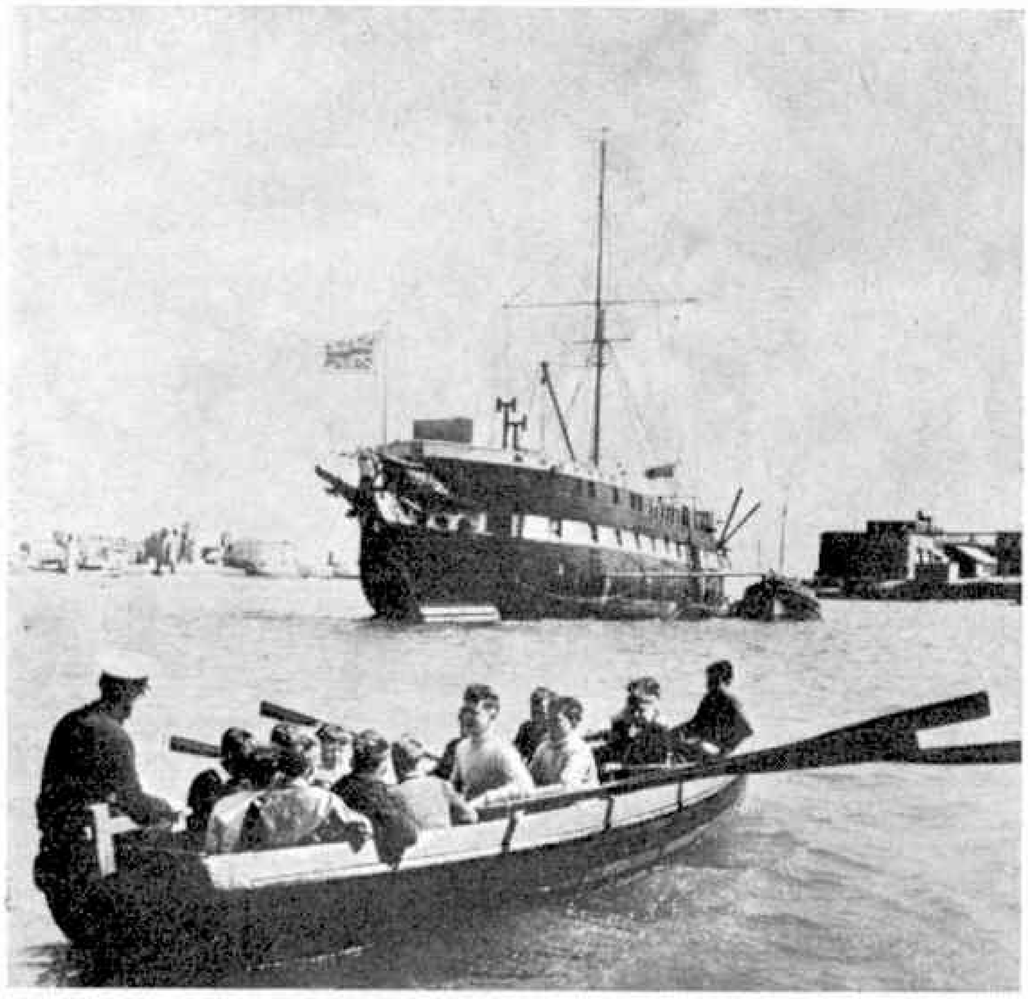
Langstone Mill has been used by millers, smugglers, rag and bone men and authors. Nevil Shute wrote some of his books here.

Above: This well preserved postmill at Bourn, in Cambridgeshire, was built about four hundred years ago and is one of the oldest—possibly the oldest of all surviving windmills in Britain.

Above: A post mill at Cross-in-Hand, Sussex.

Below: Maintenance work being carried out on the sails of a working tower mill near Over, Cambs.

Below: Fan tail and carriage assembly attached to tiller bar of the post mill shown above.



Learning to handle small boats is just one of the interesting activities the boys learn.

FRIGATE FOUDROYANT

by Stanley Oliver

Built as a Flagship over 150 years ago in the days of Nelson, the Foudroyant now serves as a training vessel for young people . . .

THIS FINE OLD 46-GUN FRIGATE was built in 1817 and was originally named the Trincomalee. One of the few remaining examples of the old sailing ships which are still afloat, Foudroyant is now well placed, lying off the Portsmouth Harbour Dockyard, linking the latest developments in ship design with the best of early design and craftsmanship. The Trincomalee saw active service in various stations for 40 years, followed by 30 years service as a drill ship in the Royal Naval Reserve.

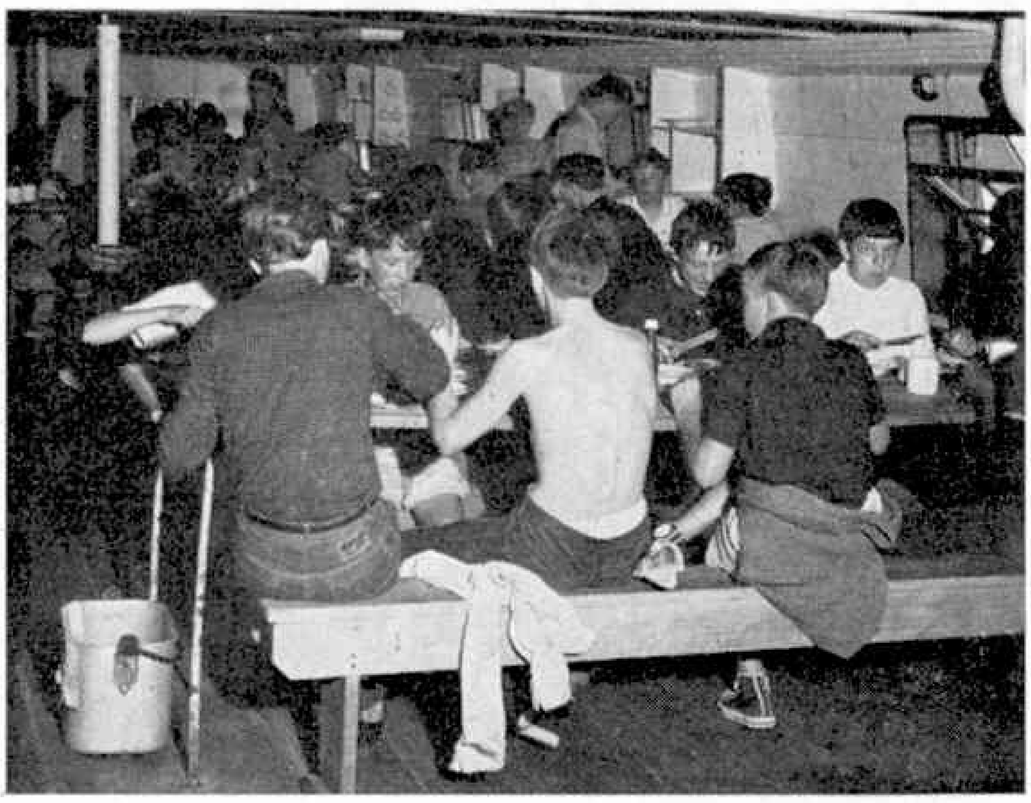
One of Nelson's flagships carried the name of Foudroyant and she was lost in a gale in 1893. The present Foudroyant thus perpetuates the memory of Nelson's ship and days of high adventure. Nelson loved the old Foudroyant and he wrote of her on one occasion—" I love her as a fond father a darling child and glory in her deeds ". Such was the feeling expressed by great men for their ships: how important it is that such ships as Foudroyant should be preserved. Arthur Bryant said—" The key to a nation's future is in her past. A nation that loses it has no future ".

I first met up with the Foudroyant in the period 1945 to 1948, when I was a member of the Sea Cadet Corps. I spent two enjoyable summer camps on board her and she was then lying in another part of Portsmouth Harbour.

I arrived late on Saturday evening, for my first camp, and I well remember the excitement which I felt as our launch approached Foudroyant: she had a special attraction at night when showing lights.

The days passed quickly as we practised seamanship and visited Royal Naval ships and shore establishments. I used to specially enjoy sitting up in the bows in the evening, yarning with fellow cadets, before turning into my hammock.

Some years ago I heard that Foudroyant was to be towed to a breaker's yard and I felt very sad. This information turned out to be incorrect, however, and I have recently been in touch with Captain Superintendent A. Langley of the Foudroyant who hastens to assure me " that the old Foudroyant is fit and reasonably well. We are still very much in business, with 1,400 children passing through our hands each year ". It turns out that Foudroyant is acting as a centre for the training afloat of young people. Apprentices from Industry, students, and members of youth organisations spend periods on board learning the elements of seamanship and gaining from the experience of comradeship and challenge of the sea. Trainees sleep in hammocks and take their meals on the mess decks at mess tables—as in the old Navy.



Appetites rise rapidly in the sea air ! Meals are eaten seated on benches on the mess-deck.

In this photograph, boys are seen learning how to handle sail. *Foudroyant* can be seen in the background.

In the days of Nelson all the crew slept in hammocks and here the boys receive instruction of how to sling one.

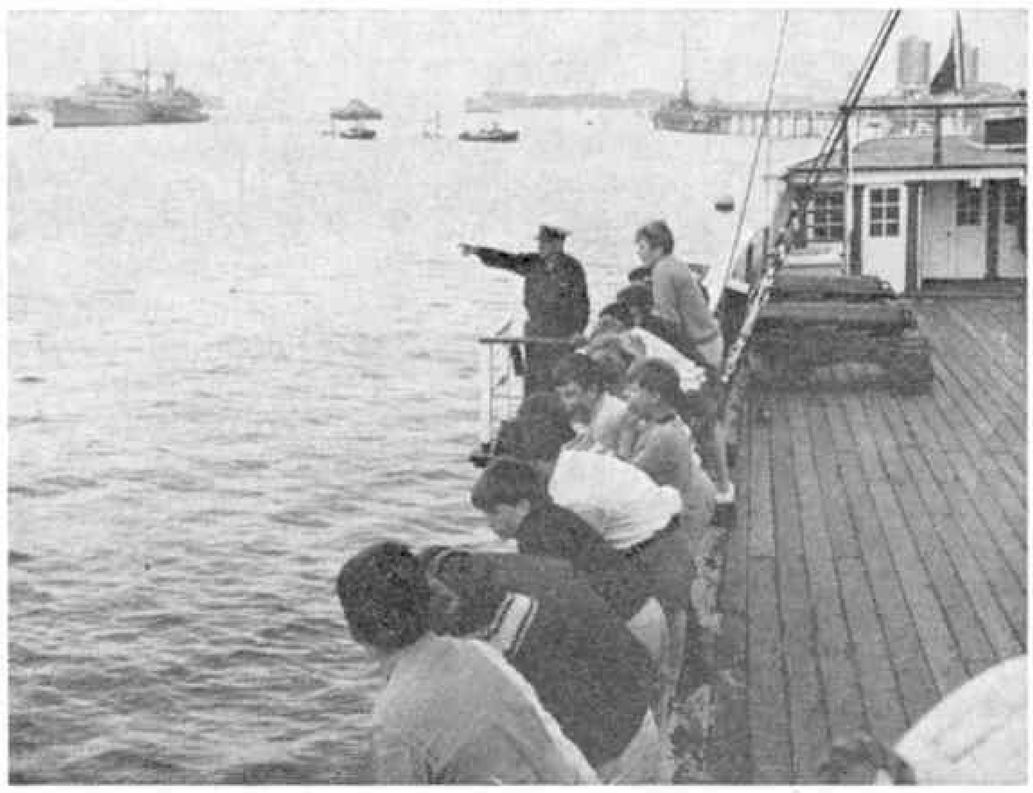
The participation of the Foudroyant in the Duke of Edinburgh's Award Scheme has been approved and a 16 mm. sound film lasting 23 minutes, explaining the work of Foudroyant, is available, free, from the County Borough Education Officer, Cliftonville, Northampton: the Headmaster of Stonebroom County Secondary School, Derby, or the Cautain Superintendent, care of G.P.O., Gosport, Hants.

From March to October, the Foudroyant can accommodate boys or girls from 11 years of age upwards, either in parties or independently, for periods of one or more weeks.

In a typical recent season, more than a thousand entries were received from a total of 21 schools and 16 youth organisations, including Scouts, Sea Scouts and Girl Guides.

Fees are kept quite low by annual grants from The Department of Education and Science and King George's Jubilee Trust: other supporters have been the Pilgrim and Dulverton Trusts and the King George VI Foundation. How very encouraging it is to find an active interest in the training and development of youth in such an attractive and historical setting.

Only just visible in the photograph is the 'double wheel.' In heavy weather four men would be required to hold it, hence the extra wheel.



There's always plenty to see in Portsmouth Harbour at the end of a day's work.

As well as the more energetic activities youngsters are also given more theoretical work and here they are seen receiving instruction on navigation.

STAMPS FOR DE GAULLE

James A. Mackay

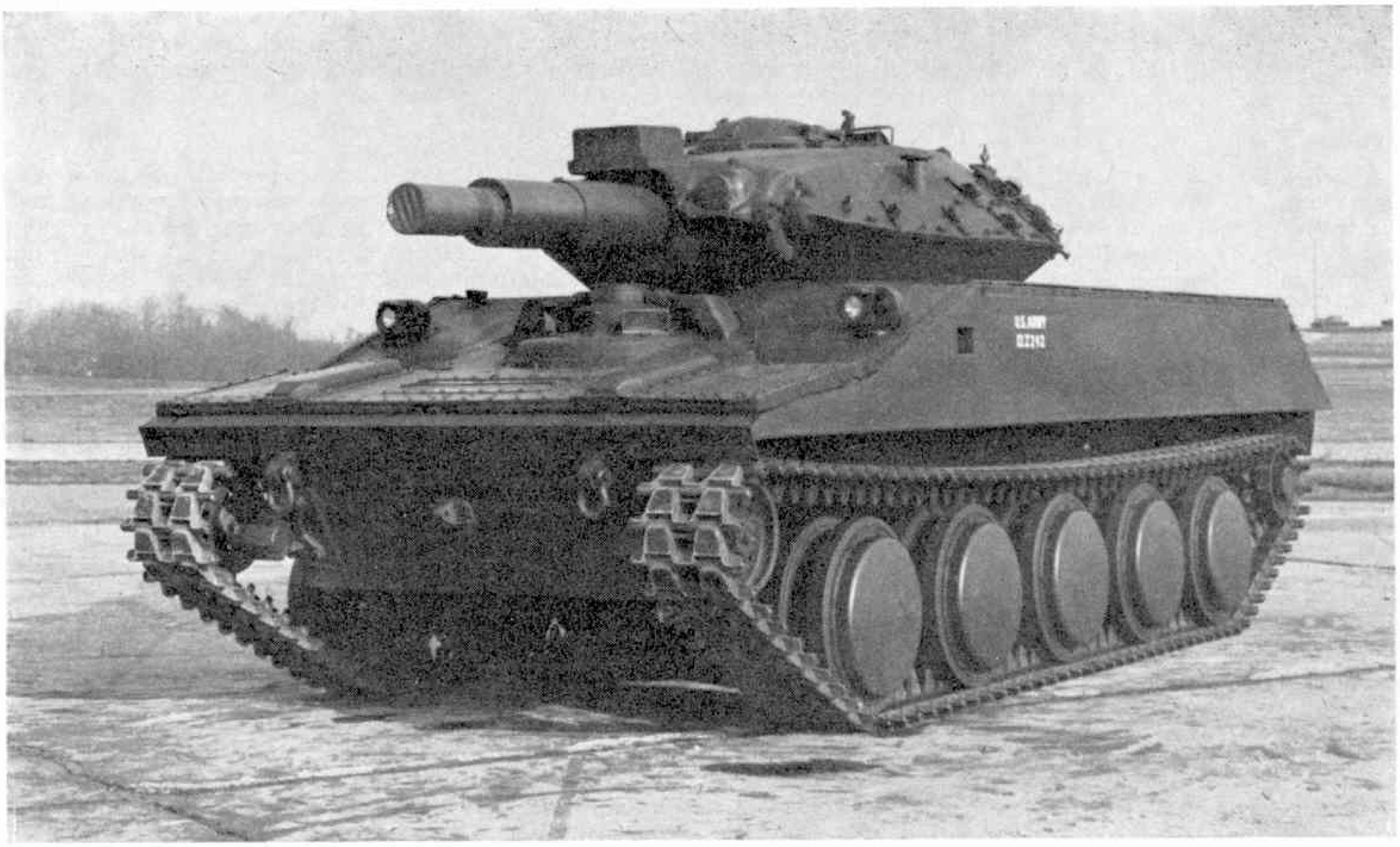
GENERAL CHARLES DE GAULLE, former President of France and wartime leader of the Free French, died last November within days of his 80th birthday. No other Frenchman since Napoleon Bonaparte has aroused so much controversy or played such a major role in world politics. It is probably too soon yet to try and assess his importance as a statesman or estimate his lasting contribution to the history of France, let alone Europe. For the moment his life and work may be summed up in the words of President Pompidou, "In 1940 de Gaulle saved our honour. In 1944 he led us to the liberation and to victory. In 1958 he saved us from civil war."

No world figure, since Kennedy and Churchill in the early 1960's, has had such a profound influence on the world in general. Bearing in mind the numerous stamps which appeared after their deaths it can be confidently predicted that there will be many stamps in the ensuing months in memory of France's great patriot. For those contemplating a collection with a Gaullist theme there is thus not a moment to lose. Fortunately there are not too many stamps already in existence which allude to the General, although several of these are fairly elusive.

Charles Andre Joseph Marie de Gaulle was born on 22nd November 1890 of an old French family (his name indicates a noble ancestry which can be traced back to ancient Gaul), staunchly patriotic, devoutly Catholic, conservative and monarchist in character. Whether young Charles saw himself as a Man of Destiny (as Napoleon is said to have seen himself) is debatable, but in choosing a military career he could hardly have fitted himself more ably for the position he was ultimately to attain. He graduated from St. Cyr in time to serve in the First World War, though the latter part of the war was spent as a prisoner of the Germans. In the years after the war he progressed steadily, if unspectacularly, through the ranks of the French Army. He first drew attention to himself by writing a book in the 1930s advocating the use of tanks to give the army greater mobility and striking power. Unfortunately the French General Staff ignored it, but not their German counterparts whose use of armour in the Blitzkrieg of 1940 led to the fall of France in June of that year. In 1940, de Gaulle, then a brigadier-general, became Under-Secretary for National Defence in the last French government before the collapse. His first job in politics lasted only eleven days before he was evacuated from Bordeaux with the remnants of the British Expeditionary Force. On June 17th 1940 he arrived in Britain and the following day made a broadcast over the BBC to his countrymen, "France has lost a battle, but France has not lost the war! France is not alone . . . I, General de Gaulle, am now in London . . ." The text of his broadcast, typed on the notepaper of 4 Carlton Gardens, London, where he established his headquarters, was reproduced on a French stamp of 1964 to mark the 20th anniversary of the liberation.

At first de Gaulle had little more than words with which to encourage and rally his countrymen, demoralised by defeat and the Nazi occupation. In October he moved to French Equatorial Africa in defiance of the Vichy government which had signed a peace treaty with Germany. He landed in Brazzaville on October 24th and the vast colonial territory went over to his Free French cause. The stamps of French Equatorial Africa were overprinted LIBRE (Free) with the date 24-10-40 to celebrate his arrival. Cameroun also signified its adherence to de Gaulle by overprinting its stamps with the date 27.8.40, while two stamps were released the following February overprinted SPITFIRE—General de GAULLE, with a 10 francs premium in aid of the colony's Spitfire fund. In 1943 de Gaulle, General Giraud (the French Commissioner for North Africa), Churchill and Roosevelt met at Casablanca. This meeting was depicted on two stamps issued by Nicaragua in 1946 in memory of Roosevelt—this was the first occasion on which de Gaulle actually appeared on stamps. During the war itself the French Underground movement, the *Maquis*, forged French stamps with a portrait of de Gaulle instead of the Vichy leader Petain, but these had no official validity and anyone caught with them faced the death penalty.

No other country portrayed the General on its stamps again until 1964 and then, curiously enough, it was another Latin American country—Mexico—which issued a stamp to honour de Gaulle's state visit. Two years later the Congolese Republic portrayed de Gaulle on a stamp marking the 22nd anniversary of the Brazzaville Conference, at which the postwar future of French Africa was planned. De Gaulle became wartime President of the French Committee of National Liberation with his headquarters in Algeria from 1943 onwards. Following the D-Day landings he returned to his homeland and took part in the liberation of Paris in August 1944. He became President of France but resigned in January 1946 when the National Assembly refused to give him the dictatorial powers necessary to put the country on its feet. For twelve years he was in the political wilderness but was recalled in 1958 following a military coup d'etat. The ten years of strong government which ensued witnessed the end of the Algerian crisis and the restoration of the French economy. In April 1970 Fujeira issued a set of seven stamps with the life of de Gaulle as its theme. The stamps portrayed him as a small boy, as wartime brigadier-general (he never promoted himself beyond this rank), with Giraud, Roosevelt and Churchill at Casablanca, with his wartime colleague Marshal Juin, a post war photograph of him with Madame de Gaulle, and finally a full-face portrait of him in military uniform shortly before his death last year. This attractive series will no doubt be followed by many others within the next few months.



U.S. Airborne Tank M551 " Sheridan "—note riveted construction.

ARMOUR IN THE SKY

Our Armoured Fighting Vehicle expert Jack Wheldon traces the history and development of the light tank . . . .

READERS WHO HAVE FOLLOWED MY SERIAL HISTORY of modern armour will know that the small, fast, thinly armoured tank originated with Messrs. Vickers in the late 'twenties, largely as a commercial venture. Various roles were envisaged for it in high-speed mechan'sed warfare, and readers interested in tank-warfare theory of those days should ask for ' The Battle of Dora ' by Graham, published by Clowes 1931, at their local library. In this book, a soldier describes co-operation between medium and light tanks in ' flanking ' and ' pursuit ' actions.

Thin-skinned little tanks contributed greatly to the swift German successes of 1939-41, when they were used to effect Strategical Paralysis of the Allied command systems. But when Hitler over-reached himself, the war changed to a process of attrition, of pitched battles and struggles for positions, and in these activities light tanks were found to have a short and not very useful life. They even lost their usefulness for battle reconnaissance, and by 1943 only the Americans were continuing their development. Curiously, the U.S. Light tank of 1945 strongly resembled the Russian T34 medium tank of 1939 !

After 1945 the general-purpose medium tank was thought most suitable for full scale war with added nuclear hazards, and the light tank, which was merely a weaker ' medium ' without any useful increase in speed or range, was of small account. The conventional light tank thus became a back number for a quarter of a century.

But in the 'sixties, arguments in favour of a new approach to light tank design repeatedly made themselves heard, and we might summarise them thus:

(a). As well as preparing against large-scale war, soldiers have an important police-type role. The Russians use heavily-equipped armoured divisions for this as in Hungary and Czechoslovakia, partly because Communist politicians do not fear accusations of ruthlessness, and partly because the Red Army enjoys interior lines of communication, which can carry heavy units direct to most important centres within the modern Russian Empire.

By contrast, British and American politicians cannot use overwhelming force against troublemakers, and they have to use road, sea, air and rail transport when sending troops to distant commitments. Under these circumstances, a light, air-portable tank-type fighting vehicle has often been wanted—but has not been available.

Upper: Scorpion prototype, the inner headlamps are infra-red. Note flotation screen foundation at track-guard level.

Lower: The Scorpion at speed in 'impassable' country. Note 'relaxation' of crew, evidence of a competent suspension.

(b). Although the conventional main battle tank is so expensive, it is easily destroyed, since no armour affords full protection against modern AT weapons, which either melt holes in it or shatter it internally with shock-waves. Some people think that a weapon-system of small related vehicles would be better than one expensive M.B.T., since while this would offer a total firepower superior to the M.B.T.'s; it would also be cheaper, it would offer a wider utility range, and its survival chances would be greater.

(c). Because of the dreadful cost of conventional war and the risk of its sliding into nuclear disaster, some soldiers are re-considering the Fuller-Liddell Hart theories of strategical paralysis, for which highly mobile armour would be essential. By highly mobile, we mean a mobility superior to contemporary civilian standards. The conventional 50 ton tank does not have this !

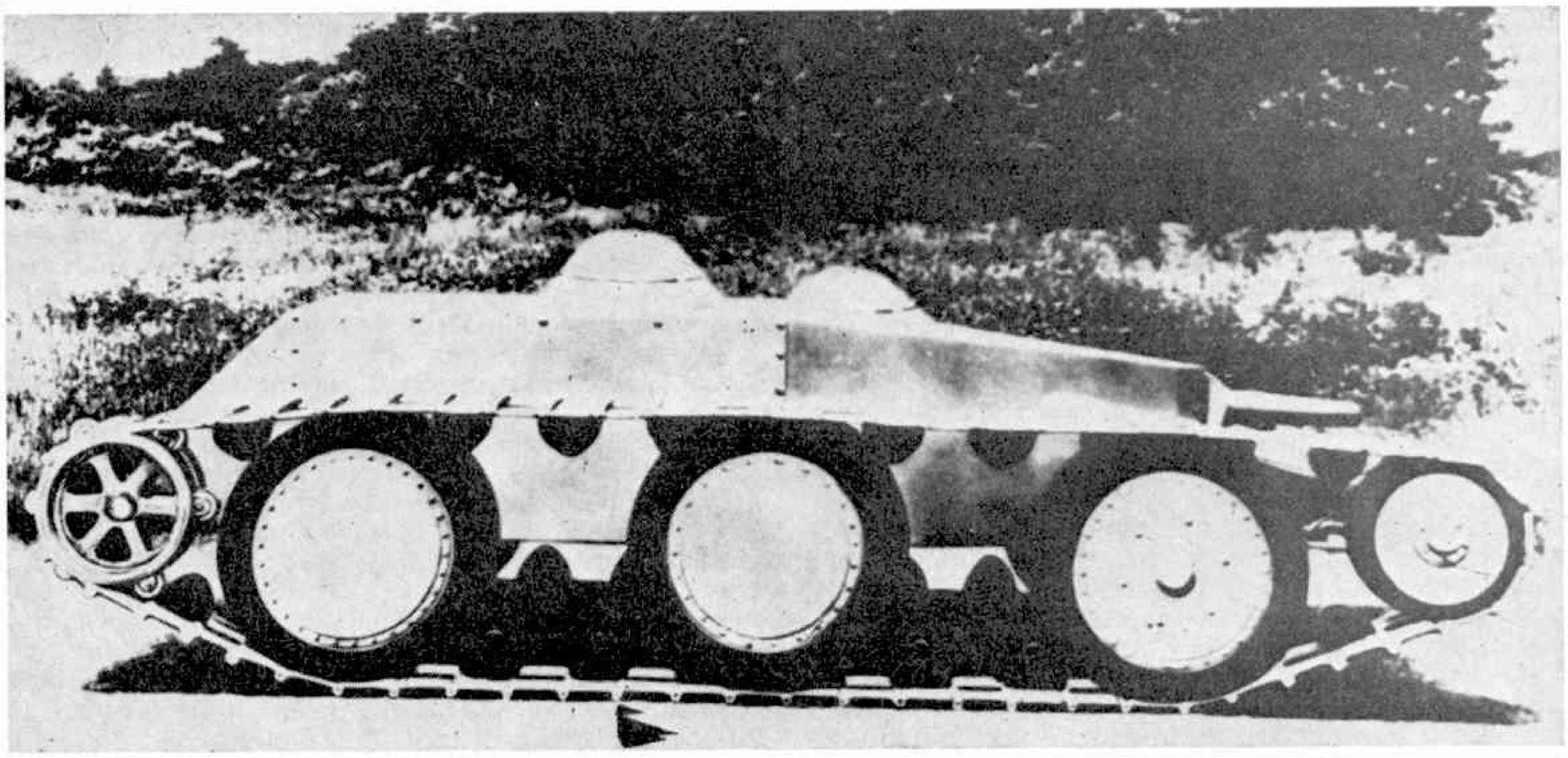
(d). A weapon system of which the parts can be purchased separately is more viable commercially than very expensive indivisible units. Not many small nations want Chieftain, but they may become regular purchasers of cheaper vehicles, each of which does part of Chieftain's work. The French have been selling a 13 tonner multi-purpose chassis since the 'fifties.

These arguments gained force until in the late 'fifties both Britain and the U.S.A. undertook development of a new class of air-portable tank-type vehicles. Vehicles which would have light-alloy armour, which could be dropped by parachute; which could cross marshes; which would be very fast over long distances. The Americans were first in production, their 16 ton M551 Sheridan entering service with the 1st Air Cavalry in Vietnam 2 years ago. The British, however, aimed not for a single tank but for a family of vehicles, and the first of these, the 7.8 ton Scorpion, is just now entering service.

Now it is clear that Sheridan and Scorpion are not conventional light tanks. The latter have always been the poor man's medium tank, with cheapness their only advantage. The main idea behind Sheridan and Scorpion is quite obviously not cheapness, for both have survived very costly development programmes. It is Availability! These are machines with a world-wide circuit of action based on air-portability, a high-power weight ratio, and a wide range of operational usefulness based on a careful choice of new and old weapons. Low production and maintenance costs are an added, and very welcome, bonus.

Their true ancestor is the Christie airborne tank built for the same reasons in the 'thirties. Mr. J. W. Christie (1866-1944), of New Jersey, entered tank design late in World War One after being commissioned by the U.S. Ordnance Dept. to build several types of self-propelled gun. He believed that speed and circuit of action were the most important characteristics of a fighting vehicle, and went on to build examples that could swim powerfully and race across country, and finally in 1932, he produced an air-portable machine which could do 60 mph on tracks or 120 mph on wheels. With 150 b.h.p. per ton, it could leap 20 feet on level going. Christies gave it a transfer gear box with a view to fitting a helicopter rotor (to solve the problem of releasing it from an aircraft) but did not pursue this line of development. He could not interest his Government in this machine, but he did not give up. He built a second one in 1933/4, and used it to demonstrate the practical possibility of dropping armour from the sky. He built an "Expendable Airborne Offense Tank" in 1938, and its companion "Airborne Tank Destroyer" in 1941, and in the last years of his life he made a scale working model of an improved version. All these machines were turret-less (Christie tended to avoid the detailed designing of fighting compartments): all featured his knee-action, telescopic, independent suspension system which gave wheel deflection up to 2 feet: all had dural wheels and light-alloy engines etc.; all had sloped, part-welded armour, and the heaviest weighed 6 tons. Their power-weight ratios were so high that additional weight could have been carried easily, and they had disc brakes all round.

They were sometimes criticised on grounds of petty unreliability, but this was grossly unfair, because they were isolated experimental machines. Such charges



Christie's 2nd Airborne AFV, M.1933/4. Shown as originally designed—a 6 wheel tracklayer, with pneumatics. Wt. 2.2 tons. BHP 250—Length 14 ft. Was later modified to become 4-wheel armoured car (no tracks). Was the vehicle in which Christie's son was dropped (successfully) from factory roof.

are never levelled against officially accepted developments, where unreliability is accepted beyond the pilot-series stage! The most honest military criticism of it was that "no funds existed for its development, because no requirement for it existed." Which can be translated to mean that it was more than fifteen years ahead of conventional military thinking. . . .

The 1932 Christie Airborne was eventually sold to Russia, but the Red Army didn't use it. Was it scrapped, or is it now in a museum? The 1933/4 model was converted to run as a 4-wheel armoured car, then dismantled and its parts put into store. The Offense Tank of '38 is now in a private collection in the U.S.A. The Tank Destroyer was used as a tracked jeep for some time, then finally scrapped. The Mark 2,a ⅛ scale model Offense Tank, is believed to have been stolen following Mr. Christie's death.

As already noted, it was not until 1956 that the British and U.S. Armies officially awoke to the possibility of using armour from the sky, and even then the motivation was not so much to effect ultra-deep penetration and strategic paralysis, as to ease the load on exterior lines of communication.

But of the Sheridan and Scorpion, which is nearer to the Christie ideal? Well, Sheridan can be dropped on 2 parachutes; its hull, and much of its insides, are made of light alloy, and its engine (like Christie's) churns out more than 300 b.h.p. It has knee-action suspension and a crew of only 3. But it is fairly large (19 feet long) and has been designed as a general purpose vehicle, and this in turn has necessitated a heavy steel turret to take the trunnion-pull from its 'Shillelagh' weapon system. The latter is a sort of combined howitzer, mortar and rocket-projector of 152 mm calibre. So Sheridan weighs 16 tons, has only 20 bhp per ton; and is more conspicuous than it should be. In my opinion it is not progressive enough; its owners have been too reluctant to drop the conventional 'tank image'.

Scorpion superficially resembles Sheridan in having an angular, under-cut turret, and light alloy armour. But it is much smaller (14½ feet overall); its engine is in front with the driver beside it on the left; its armour is assembled by welding instead of riveting and screwing (quite a break-through, this), and it is much lighter at 7.8 tons. But its power-weight ratio is not much higher, because it uses a commercial motor-car engine of only 4 litres, the Jaguar XK. Still, it can do 50 mph on the level, and it is also extremely agile. The cross-drive, which is in the nose to drive the front sprockets, is regenerative (that is, when the tank turns, the energy from the slowed down track is fed across to the outside one), but unlike earlier British steering-gearboxes of this nature it is semi-automatic—a 'hot shift' as it is called. Those who have heard a learner-driver sorting out his non-syncromesh gears on a Centurion while balanced on a knife-edge crest, will appreciate the joys of the hot shift. Scorpion, moreover, has 7 gears forward or reverse, and disc brakes all round. There are 5 road wheels on each side, of light alloy with rubber tyres, sprung on torsion bars which give 8 inches deflection. Not enough in my opinion, but still a lot more than your family car can boast. The track is of steel links, with rubber hinges, road pads and wheel paths, and very wide so that the Scorpion has a low ground pressure and is something of a marsh-buggy. The XK motor is quiet (very important) and the use of so many commercial parts makes the vehicle reliable and easy to service.

And it is light! Only 7.8 tons, for vehicle, crew and armament! Not so light as the Christie, but then, the latter did not carry much equipment—certainly not the advanced navigational and optical equipment, and the NBC clean-air pack (against chemical and nuclear hazards) that Scorpion carries. But light enough. A C/130 transport can ferry 2 Scorpions through 1,000 miles across the sky, and when under its own power it can swim across water obstacles with ease, after the quick-fitting flotation screens are snapped together.

Again like the Christie, it has been designed first and foremost as a parent type from which a team of fighting vehicles can be created, and this is undoubtedly a good thing. Development of this work has been entrusted to Alvis Ltd., who in the 'thirties, pioneered the manufacture of monocoque—construction armoured cars in this country, and who, in the early fifties,

collaborated with the Army in evolving the highly successful 6 × 6 wheeled AFV family—Saladin, Saracen and Stalwart. This 'S' name tradition is maintained by Alvis with the new vehicles—and the new names are delightfully apt. Thus, Scorpion has its deadly sting in the rear-mounted turret—a light-weight semi-automatic 76 mm. cannon. This may seem small-calibre compared with the MBT's 120 mm. weapon, but it delivers an adequate H.E. shell in the fire support role, and can penetrate MBT armour at any range with HESH (Squash Head) ammunition, which does its work through shock waves and does not try to punch a hole by brute force and weight. This versatile gun also fires smoke and star shell, and (this may sound Napoleonic) canister as well, for dealing with close range targets in guerilla warfare—a deadly answer to the jungle ambush. Needless to say, a machine gun is mounted co-axially with the cannon. If required, Scorpion can be equipped with a smaller cannon—the Rarden semi-automatic 30 mm.—having a larger ammunition reserve, and this is known as SCIMITAR.

Scorpion's running mate is STRIKER, specialising in the anti-tank role. Striker has a crew of 2 and a remote-controlled unmanned rocket launching turret. The launch is programmed, making it very quick into action, and so capable of action against close-range targets, whether armour or fortified position.

A fully-equipped infantry section of 7 men can travel in SPARTAN, the armoured personnel carrier. It has a slightly modified turretless hull, with a cupola fitted with machine gun and advanced optical equipment.

Control of large formations is effected from SULTAN, the armoured command vehicle. The hull resembles Spartan's, but has 12 in. greater headroom, a luxurious telecommunications console, and a tent extension.

Casualties to both men and machines must be given every aid, and to rescue the former we have SAMARITAN, a 4 berther, which will give a more comfortable ride on difficult ground than almost any wheeled vehicle. An armoured ambulance is essential in danger zones—especially when the enemy are guerillas who do not observe a civilised code of warfare.

Vehicle casualties are rescued by SAMSON the A.R.V., with his twin spades at the rear, his internal winch, and experimental equipment for rescuing 'drowned' vehicles on amphibious operations.

And that is the 'new look' family of light-alloy, air-portable British AFVs that Alvis and the Fighting Vehicle Research and Development Establishment are jointly creating. Can it herald the kind of development in military theory that Christie anticipated 40 years ago? Mechanised armies with armour from the sky, getting around at really high speeds, and jumping on trouble before it can get dangerous? Can it be that we are about to witness the fade-out of the 50 ton MBT? After all, the latter is something of a dinosaur, and we know that those monsters were replaced by animals a lot smaller and a lot more agile.

The writer wishes to express his gratitude to ALVIS LTD. for their kindness in providing data and photographs of the SCORPION family.

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by a member of our Royal Family who performed the opening ceremony as well. The Prince of Wales opened Tower Bridge on June 30, 1894, after having performed the laying of the foundation stone some eight years earlier.

The Bridge is one integral whole, though consisting of two bascule leaves and two suspension bridges. In addition to the two main towers, which are of steel and are built on the piers, there are two smaller ones on the shore, one on the Surrey side and the other on the Middlesex bank.

From these land towers stretch straight anchor ties that go right through the road to be riveted to a huge anchor tube kept in place by many tons of concrete. Between the main towers and the smaller towers hang the chains suspending the shore spans.

In 1961, however, the load of the chains was altered. Up to that year, the top of the chains on the north side was connected to that on the south side by steel ties, and the weight of these ties was taken by the high level footways. Since April, 1961, the load has been transferred to 2-inch lock coil cables suspended from the main top pins conecting the long chains and ties.

Allowance has also been made for expansion and loading of the bridge by enabling the connected chains and ties to rest on special roller bearing plates attached to the four towers. In fact, the steel-work between the anchors on the approaches extends for nearly a quarter of a mile!

Nearly 37,000 tons of concrete, 27,260 tons of brickwork, and 30.000 tons of masonry went into the building of the Tower Bridge, and its construction consumed 20,000 tons of Portland cement, 11,300 tons of iron and steel (not including machinery), and 1,500 tons of cast-iron. It required 3,900 tons of granite and 5,700 yards of wood for the 9,500 superficial yards of footway paving, and the total cost was more than £1,000,000—equivalent to at least £10,000,000 today.

Each bascule leaf weighs over 1,000 tons and rotates on a shaft 21 inches in diameter carried on roller bearings. Concealed inside each main tower is a counterpoise member which balances the visible part of the bascule pivoted there.

Two geared quadrants on each counterpose engage with pinions driven by two hydraulic engines, the latter being housed and arranged in such a way that either is capable of raising and lowering the bascule alone under normal conditions. Each bascule is also independently controlled, and all the operations are performed—mostly by remote control—from cabins on the downstream side of the Bridge.

Because it can be lifted to let ships pass through, the Tower Bridge does not prevent vessels up to 10,000 tons from going up the Thames beyond the Port of London.

London's Model Bridge

ARTHUR GAUNT

AN ENGINEERING WONDER WHICH INSPIRED a well-known early Meccano model is entering a new stage in its 75-years' history, scientific tests having revealed that London's familiar Tower Bridge is likely to be unsafe for heavy traffic after 1980. It is expected to be substituted by a road tunnel for vehicles, but to remain in use as a pedestrian way.

The need to span the Thames by another bridge became pressing in the 1870's, when the horsedrawn transport in the Metropolis was rapidly expanding and the bridges already existing were unable to cope with cross-river traffic adequately.

A site for a new one was agreed upon by the Corporation in 1877, a study of traffic conditions having shown that a point just above the Pool of London would be the most suitable. Designing the structure presented problems, however, for it was vital to take into account the interests of shipping as well as those of land traffic.

The answer was the bridge which is now a London landmark, consisting of two huge piers connected by two bascules or leaves capable of being raised for the passage of ships. When the bridge is open, there is a clear waterway 200 ft. wide, with a height of 140 ft. at high tide. So although large ships still cannot go beyond this point (the water would be too shallow in any case), vessels with masts as high as 140 ft. can sail upstream from the Pool.

The commission for designing the Tower Bridge went to Sir Horace Jones, City Architect of the time, and responsibility for the engineering work was accepted by Sir John Barry, son of the architect of the Houses of Parliament. Also associated with the bridge project was I. K. Brunel, constructor of the steamship *Great Eastern* and chief engineer of the Great Western Railway.

Jones's bridge has not received universal commendation. Whilst it has been described as "the most monumental example of extravagence to be constructed in the world," it has also been said to "represent the vice of tawdriness and pretentiousness." Another critic last century stated that the exceedingly heavy chains attached to the towers would inevitably bring them down.

Nevertheless the bridge has escaped that dire fate, and is becoming obsolete mainly because nowadays it has to carry a greater weight and volume of traffic than was envisaged 80 years or so ago, rather than as a result of any inherent faults in its design or construction.

The piers differ from those of an ordinary bridge, having to accommodate the hydraulic machinery which lifts the bascules, as well as to support the towers, the overhead girders across the opening span, and the suspension chains of the fixed spans.

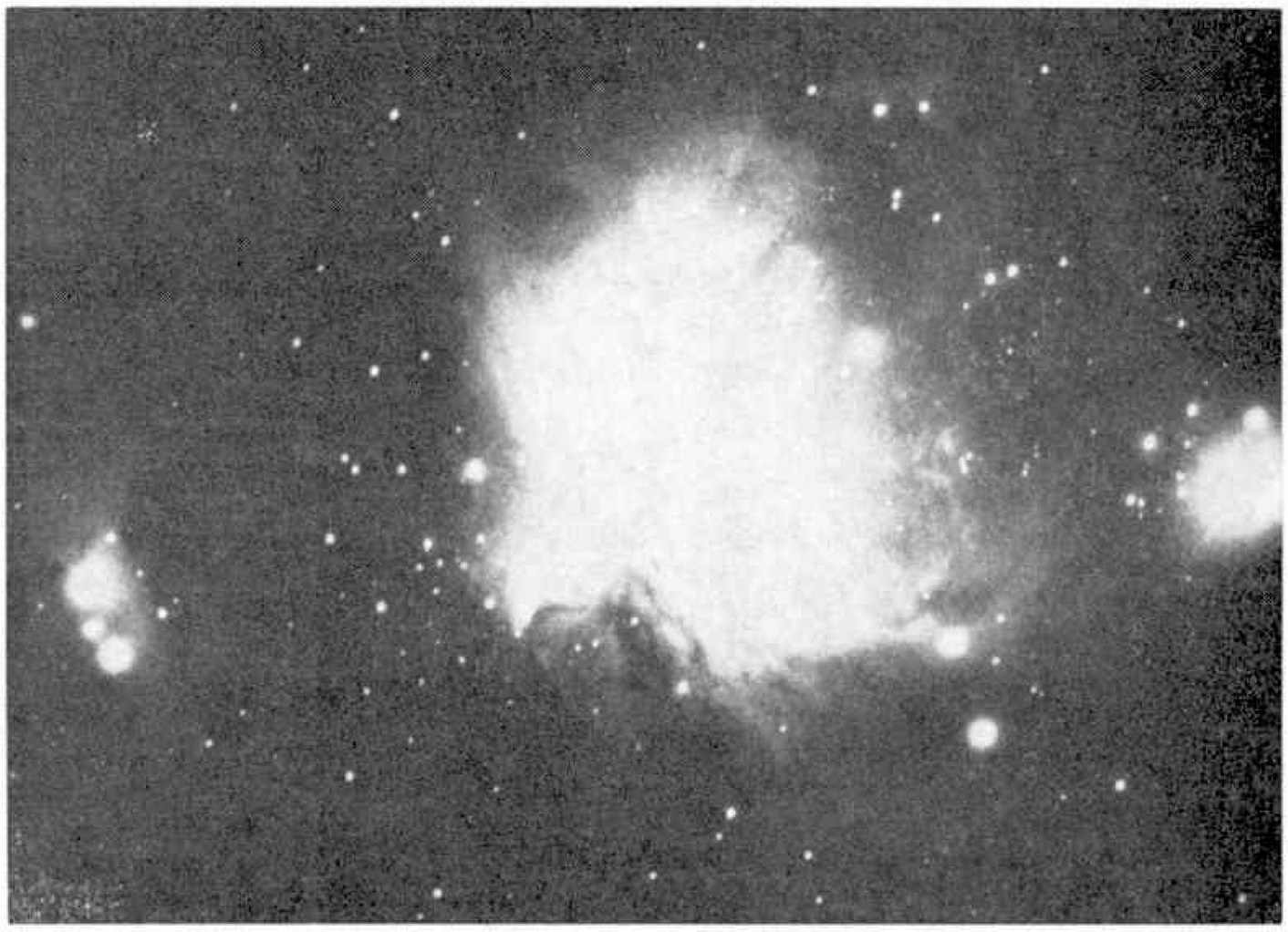
Work on this masterpiece of civil engineering began in 1886, and it took eight years to complete. It is one of very few structures to have a foundation stone laid

Continued opposite

IMPORTANT DISCOVERIES IN ASTRONOMY

by

Charles A. Rigby



The Great Nebularin Orion. Taken with "Fullerscope" 11¾-in. Cassegrain-Newtonian telescope, employing standard drive and 15-min. exposures by Dr. R. Barrow in Trinidad. *Photo by courtesy "Fullerscopes."*

WITH THE INVENTION OF THE TELESCOPE, this was a great advantage in astronomy, and there were important developments during the last two, and present century. Three new planets in the solar system, making a total of nine altogether, were located. The other five planets, excluding the Earth, namely, Jupiter, Saturn, Mercury, Venus and Mars, were known to the ancient Greeks.

The first discovery was in 1781, when William Herschel, a music-master and amateur astronomer, discovered Uranus with the aid of a home-made telescope. Located quite by accident, he merely looked at one star after another until he finally saw to his astonishment a newcomer, having not the slightest notion that any such planet was likely to exist. Though partly due to amazing luck, his discovery was the climax of years of painstaking effort. The planet was found to be about 19-times the Earth's distance from the Sun, and therefore almost exactly twice as far out in space as Saturn. Its distance from the Sun, approximately, is 1,783,000,000 miles. It is relatively small when compared to the largest planets, Jupiter and Saturn, its diameter being 32,000 miles or nearly four times greater than that of our Earth.

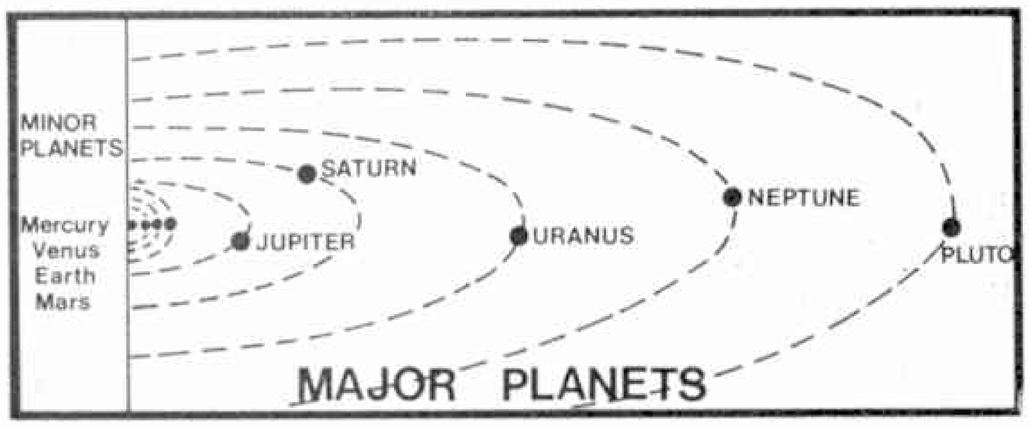
After its discovery, the new planet was carefully watched and was found to have a strangely uneven motion. According to the law of gravitation by Kepler, it was not following the course it should have done. This law states that every planet moves round the Sun in an ellipse. If not interfered with in any way, merely guided by the Sun's attraction, it will continue to describe precisely the same ellipse without the slightest alteration. In actual fact, however, none of the planets perform this simple revolution because a gravitational pull varies according to the size and distance between two heavenly bodies.

When calculations had been made which showed how much the known planets could disturb Uranus, it was found that there was still a deviation that remained unexplained. By ordinary standards the deviation was microscopic. In 1844, it had grown as large as 1/16th of the Moon's apparent diameter or 135 miles. Bearing in mind that Uranus is so far distant from the Sun, astronomers still considered this deviation an intolerable error. Since none of the stars could produce such an effect, being so far off, they concluded that there must be another planet which was causing the uneven motion of Uranus.

Nothing was done at this stage until 1843, when John Couch Adams, a 24-year old graduate at Cambridge decided to solve the problem mathematically. At the same time in France, another astronomer undertook to solve the same formidable problem. As a basis for their work they had only the recorded deviations of Uranus extending roughly over one century. To compute from this data precisely what direction in the heavens astronomers were to point their telescopes at some given time in order to find the faint speck which would be the planet affecting Uranus, required a lengthy and elaborate analysis.

In 1845, Adams actually sent his solution to Sir George Airy, then Astronomer Royal, with a request that a telescope search be made for the predicted planet. For some unknown reason, however, his request was shelved, and the computations remained hidden in pigeon-holes. In the following June, however, Urbain Jean Joseph Leverrier of Paris arrived at his solution, and forwarded his famous letter to Johan Galle of

MAJOR PLANET ORBITS



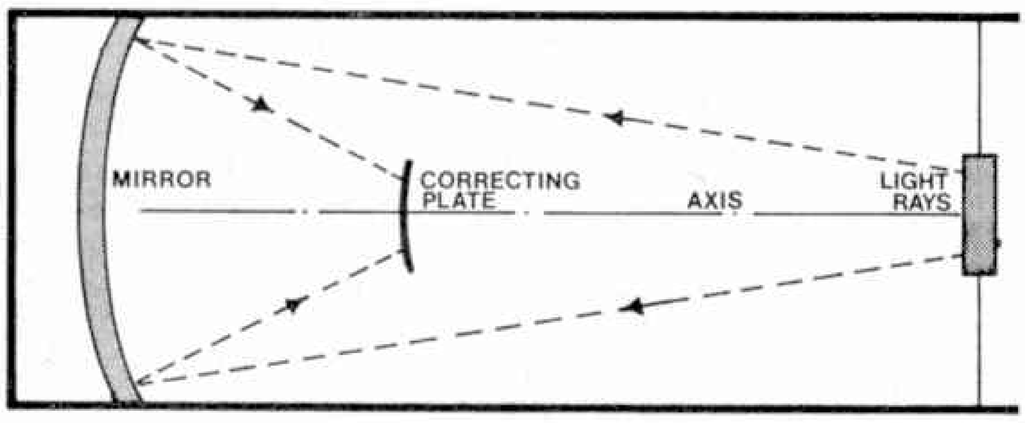
This diagram by the author shows the comparative orbits of the major planets in our solar system; Earth incidentally is the 4th from the left.

Berlin Observatory. On the night of September 23, 1846, Galle began his search among the flickering pin-points of the constellation of Aquarius and within 30 minutes the lens of his instrument mirrored the scarcely perceptible disk of Neptune, eighth planet of the solar system, only one degree from the predicted position. Later, it was found that the prediction of John Couch Adams tallied with that of the French astronomer, Leverrier.

For both Adams and Leverrier who had predicted the position of Neptune by a process of intelligent guessing, it was an outstanding triumph. They drew a circle outside Uranus, and supposed that a planet was revolving in it. They would then calculate the effect upon Uranus and see if it could account for the deviation. The first supposed planet they tried would not do, then they began with another, until at last after much hard work, they began to realise that there might be a planet in a particular path far beyond Uranus, such that if this planet were of the right weight and moving with the right speed, then it would pull Uranus exactly in the way that astronomers had observed it to be pulled.

Some 2,797,000,000 miles distant from the Sun, Neptune, named after the great God of the Ocean of

DIAGRAM OF THE 'SCHMIDT' TELESCOPE

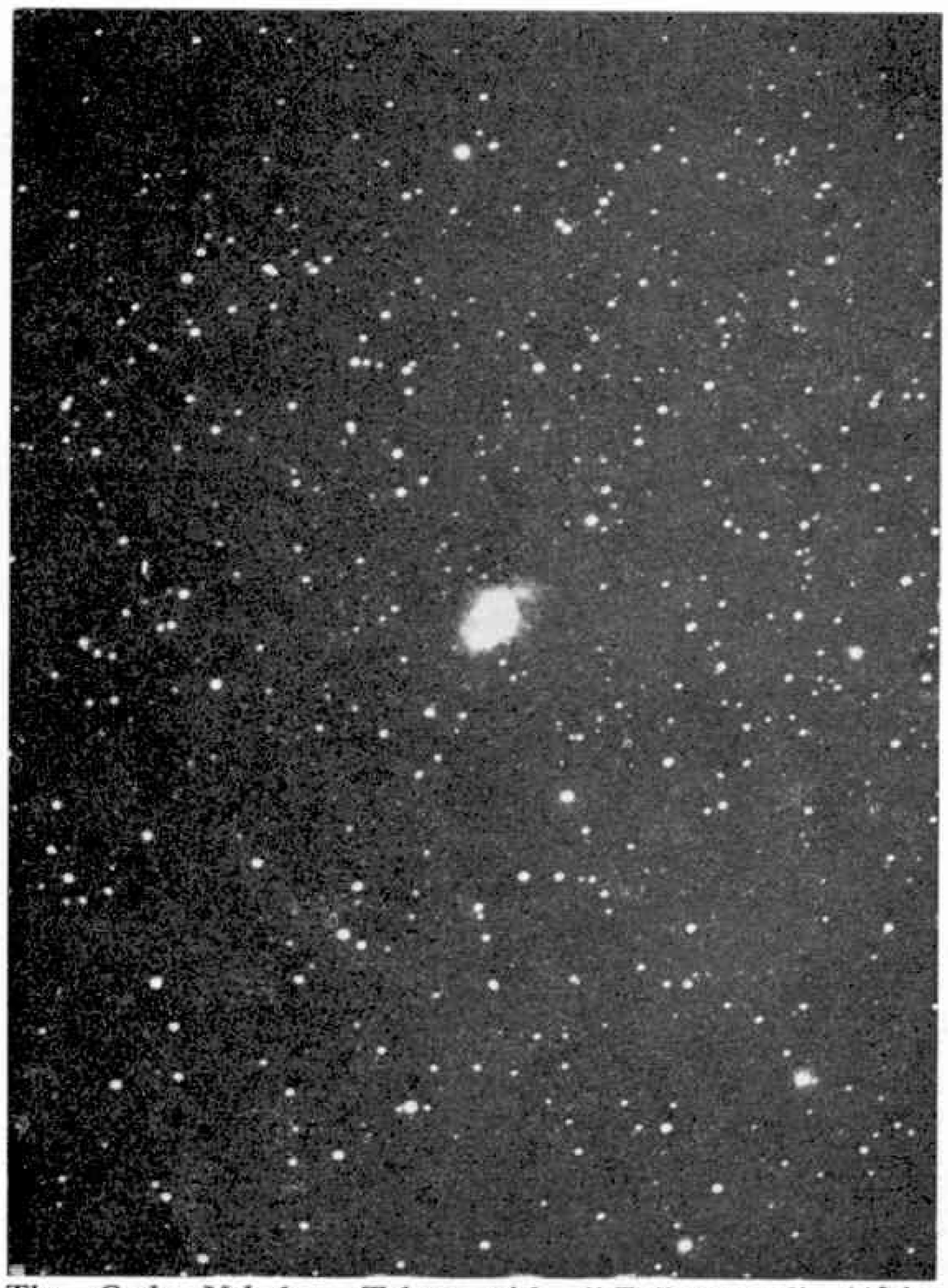


The parabolic reflector consists of a spherical mirror on which is super-imposed a thin correcting plate which corrects for the spherical aberration. With the plate at the centre of curvature, a large field of definition is obtained, the image being received directly on to a photographic plate bent to fit the field surface.

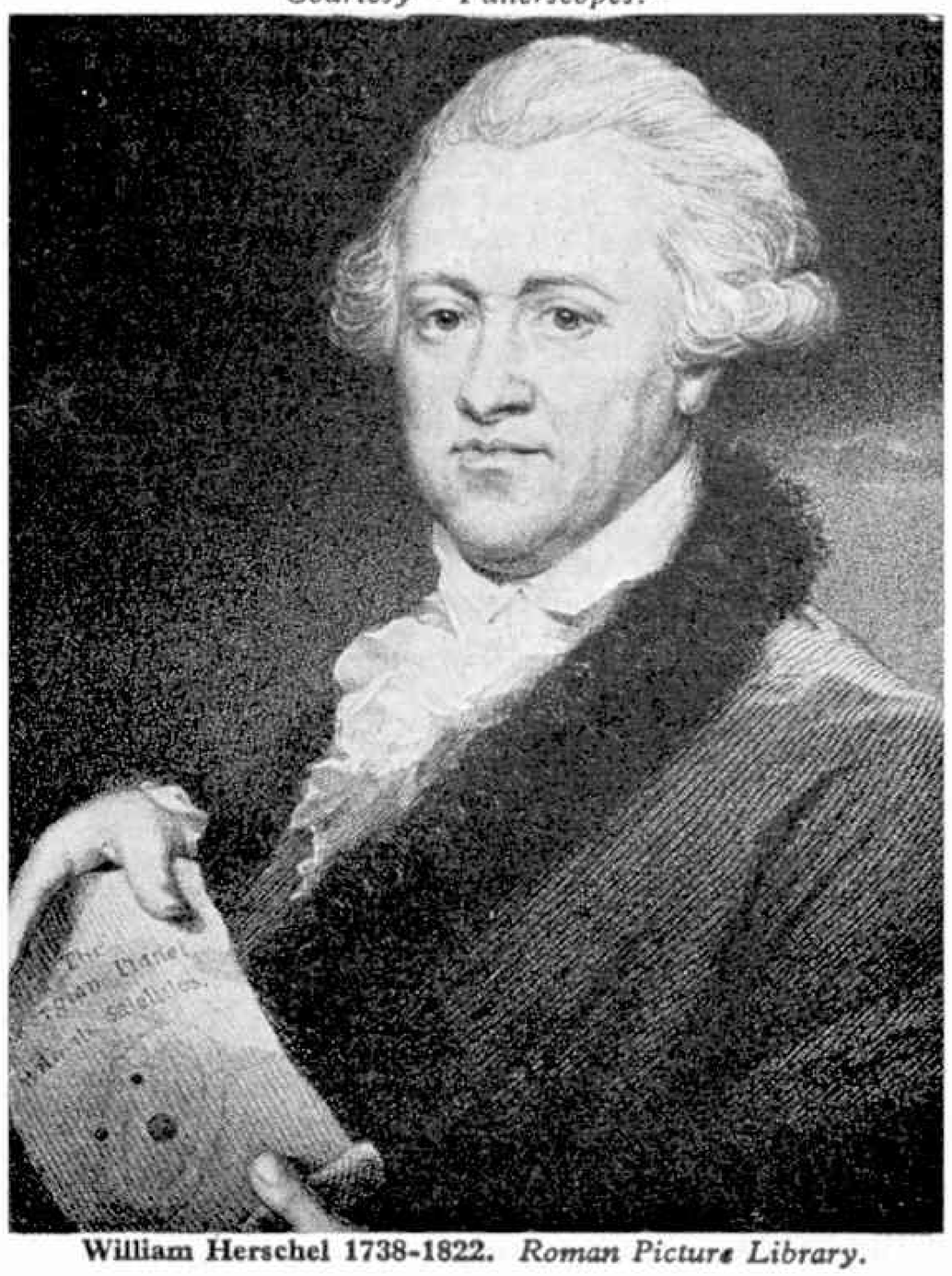
Greek mythology, is nearly the same size as Uranus, and has a diameter of about 31,000 miles. It moves slowly in an enormous orbit round the Sun, taking nearly 165 years to complete the journey. Since its discovery, Neptune has not yet completed one revolution. Another new planet, Pluto, ninth planet in order of distance from the Sun or 3,670,000,000 miles, was discovered in 1930 by Clyde Tombaugh at Lowell Observatory, Arizona, after a detailed mathematical investigation had indicated its position. Its diameter is 3,650 miles and it takes nearly 248 years to complete its revolution round the sun—even longer than Neptune.

The present century has also seen a complete revolution, with the invention of the 'Robot Astronomer' to begin the first real census of the stars and which can work hundreds of times as fast as a human being. Known as GALAXY or General Automatic Luminosity and XY measuring machine, it was installed at the Royal Observatory in Edinburgh, early this year. The machine, basically is a high accuracy two-dimensional co-ordinate table fitted with means of precise photo-electric examination of star images on a photographic plate, its overall dimensions being 8 ft. × 6 ft. × 7 ft. high and weight 3.6 tons.

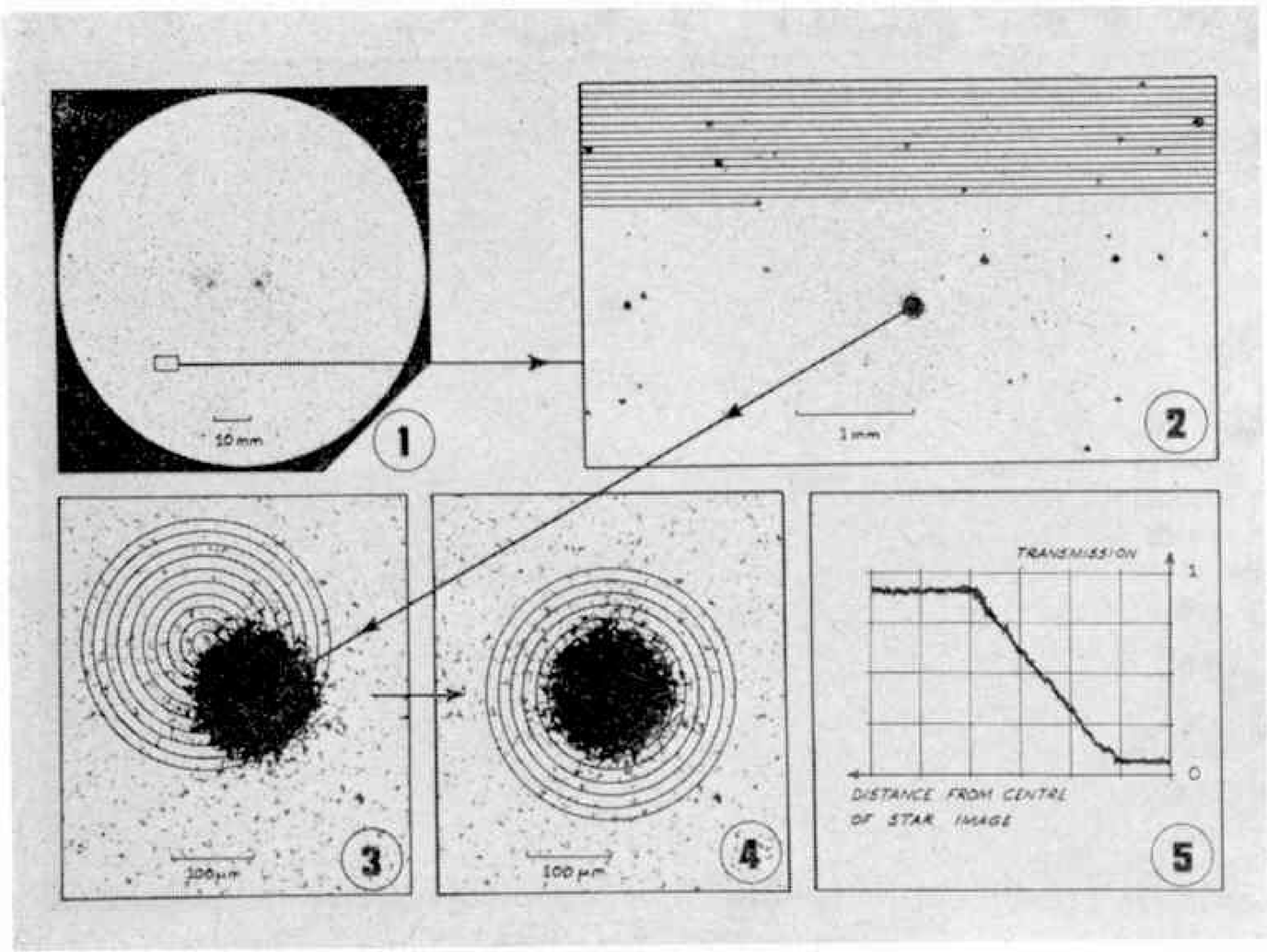
The machine is the first of its kind to bring complete automation to processes of optical astronomy. Coupled with the Observatory's 16-inch Schmidt telescope, and a computer system it enables astronomers to programme their work in such a way that considerable quantities



The Crab Nebula. Taken with "Fullerscope" 11¾-in. Cassegrain Newtonian telescope, employing standard drive and 15 min. exposures by Dr. R. Barrow in Trinidad. *Photo by Courtesy "Fullerscopes."*



William Herschel 1738-1822. *Roman Picture Library.*



Part 1 shows a photograph taken with the Schmidt telescope. The stars have produced black images on the negative. A typical photograph contains 40,000 images. An area of the negative is selected for measurement.

Part 2 shows the selected area of the negative enlarged. GALAXY searches the selected area for the star images, using linear scanning.

Part 3 shows a single star image greatly enlarged. GALAXY scans the star image, using concentric circle scanning.

Part 4 shows the same star image.

Part 5 shows a drawing of the ascilloscope display on GALAXY. GALAXY measures the profile of the star image to a quarter of a micrometre.

of astronomical data can be taken from the telescope by the ' Galaxy ' machine and fed into the computer for their results to be analysed in a fraction of the time that it has taken in the past. In designing the machine, four main features were decided upon: (1) A cathode ray tube to scan the photograph with a spot of light, for finding the star images and measuring their sizes and densities, (2) a precise mechanical carriage to hold and position the plate with an accuracy better than a ' micron ', (3) A system developed for measuring the carriage position to a ' micron ', and (4) an electronic system similar to a computer to control the operations.

The invention of the Schmidt telescope more than 30 years ago provided astronomers with the means of recording information about the stars at an unprecedented rate. A single photograph of an area of the sky a few times the size of the Moon, taken in a few minutes on a clear, dark night by a Schmidt telescope of even moderate size, records images of tens of thousands of stars. Such photographs contain a wealth of information. The light from a single star is focused by the telescope to form a spot of light only a few tens of microns across. The light is scattered and absorbed by the photographic emulsion; the brighter the star, the further the light spreads out in the emulsion, so that when the photograph (a negative) is developed, the images of bright stars are larger and more dense grey spots than those of faint stars. The measurement of the strength of a star image is consequently a mattər of measuring its size and density, sizes typically lying in the range from tens to hundreds of microns.

With ' Galaxy ', images of the stars are found on the photograph, and their positions, sizes and densities are measured with precision and at high speed. The requirements laid down were that the precision of measurement should be one micron in the position of a star image, and a quarter of a micron in the size, and that the machine should find and measure a 1,000 star images an hour, entirely automatically. The machine works as follows: To find the star images the photograph is scanned by a small spot of light, produced by a cathode ray tube and projected down to a chosen size, 16 microns across being typical. The light passes through the photograph and is measured by a photoelectric cell. The passage of the spot of light over a star image is then detected by the cell as a reduction in brightness, and the position at which the event occurred is recorded. With this resolution of 16 microns, the plates currently being measured are searched at a rate of 30 square millimetres per minute, 10,000 stars being found and recorded per hour.

When the star images have been found, the carriage carrying the photographic plate is moved to put each star in turn beneath a scanning system working at high magnification, for a more detailed examination of each image.

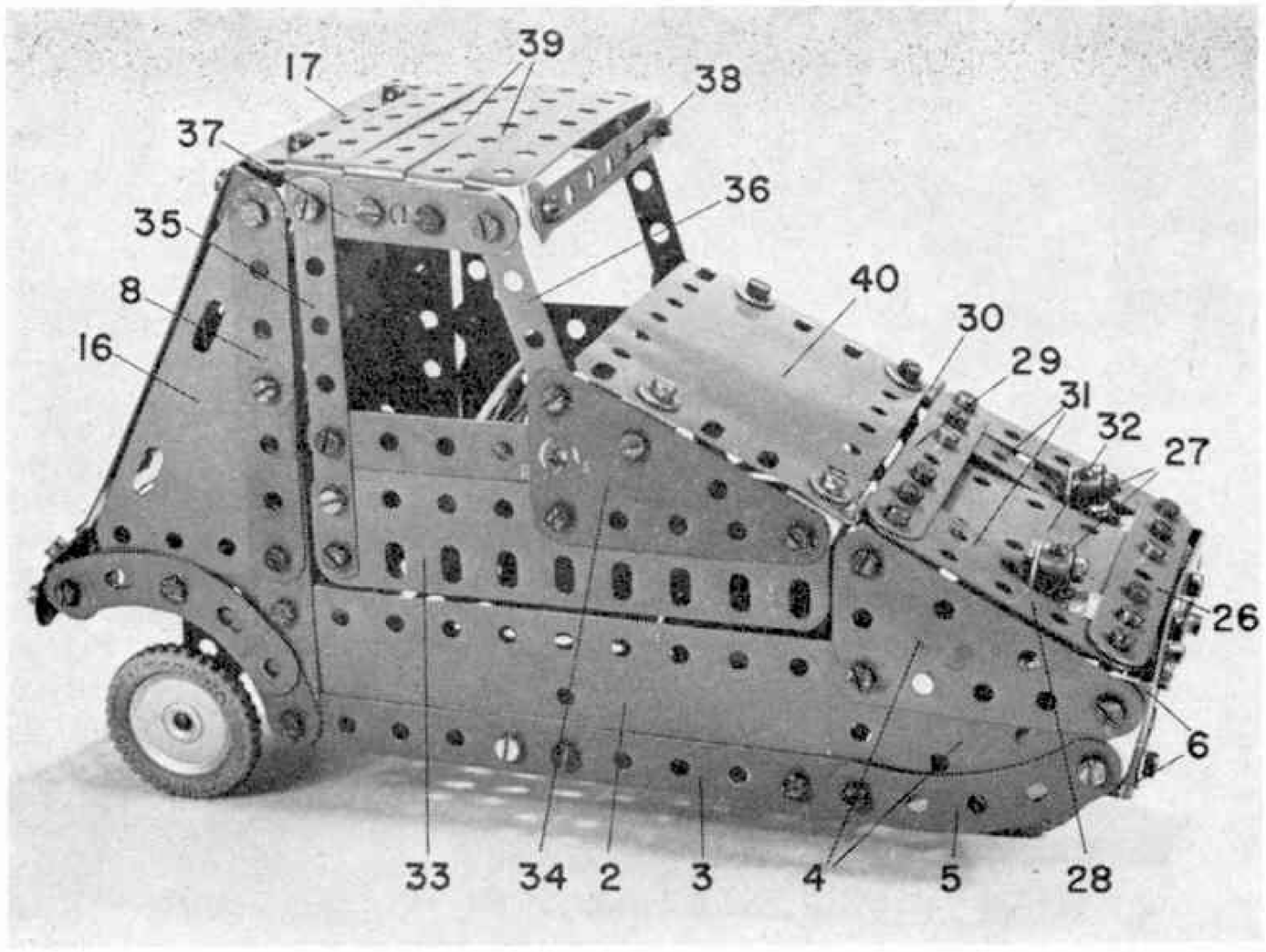
3 WHEELER *Continued from page 86*

connected by a 2 in. Strip 37, the securing Bolts fixing two $3\frac{1}{2} \times \frac{1}{2}$ in. Double Angle Strips between the sides, the front securing Bolt also holding an Angle Bracket in place. These Angle Brackets at each side are connected by a $3\frac{1}{2}$ in. Narrow Strip 38. Two further $3\frac{1}{2} \times \frac{1}{2}$ in. Double Angle Strips 39 are bolted between Strips 37 to complete the roof, then a $3\frac{1}{2} \times 2\frac{1}{2}$ in. Flexible Plate 40 is attached to Triangular Flexible Plates 34 by Angle Brackets, the forward securing Bolts also fixing the completed assembly to Hinges 30.

Last of all, two Fishplates are bolted, as shown, to lower Double Angle Strip 6 to finally complete the entire model.

PARTS REQUIRED

2—2	1—16a	9—48b	3—142c
4—2a	1—16b	3—53	1—185
9—3	1—18b	9—59	1—188
4—5	3—22	2—90	2—189
3—6	1—26	4—90a	1—190
2—6a	1—32	2—103c	2—190a
8—10	110—37a	2—111a	6—221
10—12	105—37b	4—111c	2—225
1—12a	24—38	2—114	3—235
4—12c	1—47	1—116	3—235b
1—16	1—48a	1—140	



MECCANO THREE WHEELER

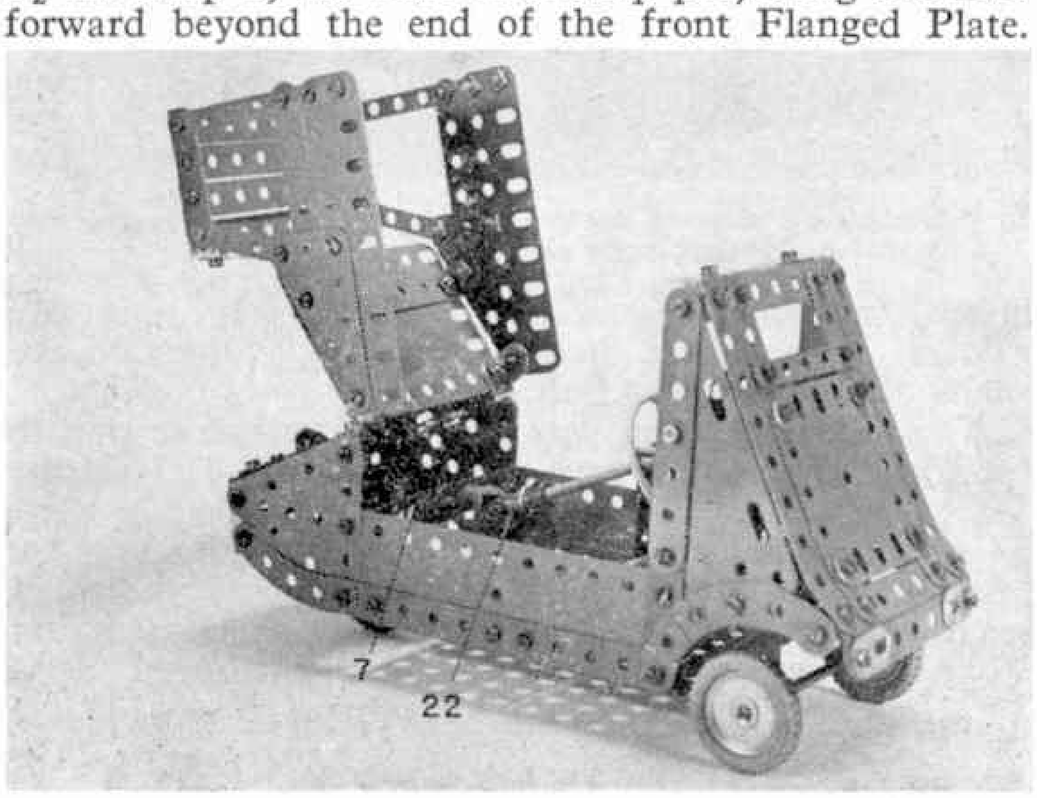
A simple model described by 'SPANNER'

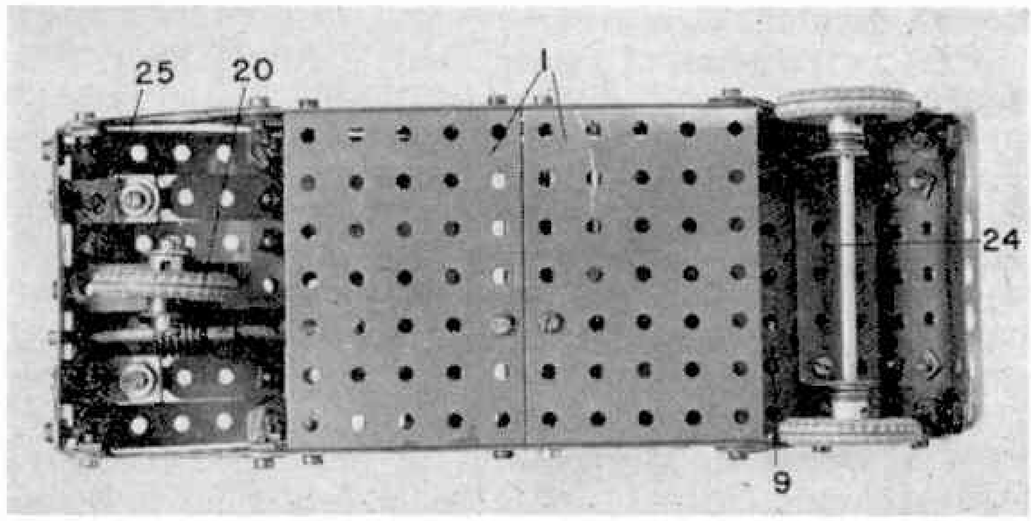
WITH THE TREMENDOUSLY HIGH ROAD and petrol taxes in operation today, plus the cost of insurance permiums, the average British motorist is more than a little interested in cheaper forms of private road transport and one of the cheapest types of motorised transport is undoubtedly the 3-wheeler.

While having most of the attributes of a motor car, the typical 3-wheeler has a much lower petrol consumption, pays a fraction of the road tax and, at the same time, does not suffer any higher insurance premiums. Obviously, therefore, 3-wheelers are of interest and, as we on the M.M. like to reflect current interest whenever possible, we felt it was time to present another Meccano 3-wheeler for readers to build. Although not intended as a direct copy, inspiration for the model came from the recently introduced Bond Bug—that futuristic and utterly unique vehicle from Bond-Reliant which we reviewed in the October M.M.—and a glance at the accompanying pictures will show the unmistakable similarity.

Construction should present no problems, even for younger readers. A base is built up from two $3\frac{1}{2} \times 2\frac{1}{2}$ in. Flanged Plates 1 connected together at each side by a $5\frac{1}{2} \times 1\frac{1}{2}$ in. Flexible Plate 2, overlayed by a $5\frac{1}{2}$ in. Strip 3, the Plate and Strip projecting one hole forward beyond the end of the front Flanged Plate. Bolted to the forward end of the Plate are two $2\frac{1}{2} \times 1\frac{1}{2}$ in. Triangular Flexible Plates 4 and a $2\frac{1}{2}$ in. Curved Strip 5, arranged as shown, the end of the Curved Strip being connected to the overlapping apexes of the Triangular Plates by a Fishplate, the securing Bolts also fixing two $3\frac{1}{2} \times \frac{1}{2}$ in. Double Angle Strips 6 between the sides of the model. The Bolts fixing the Triangular Plates to the upper forward corners of Plates 2 also secure another $3\frac{1}{2} \times \frac{1}{2}$ in. Double Angle Strip 7 between the sides.

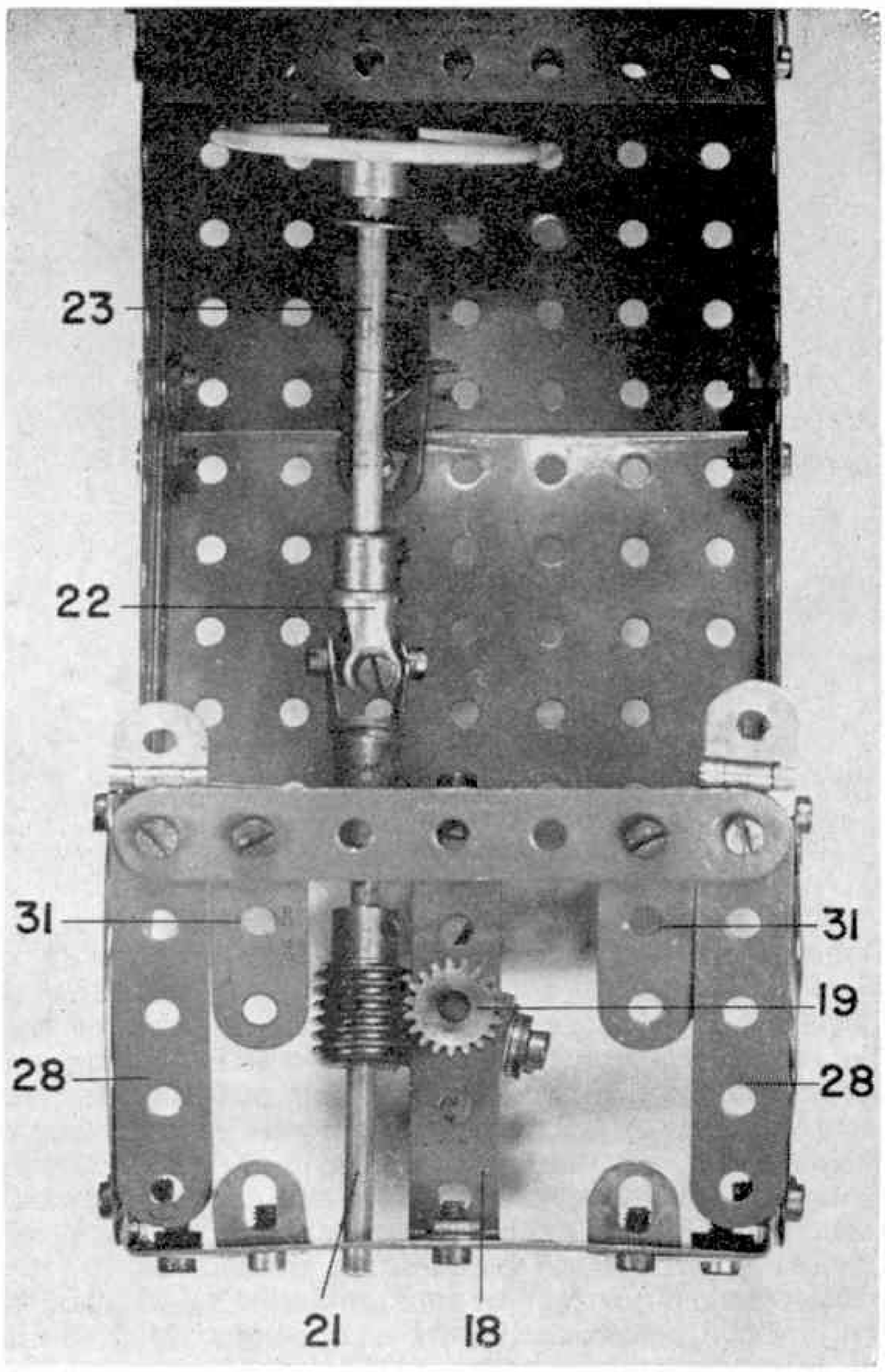
Now bolted to the rear end of Strip 3 and Plate 2 is a vertically-positioned 5 in. compound strip 8 (built up from two $3\frac{1}{2}$ in. Strips) and a $2\frac{1}{2}$ in. Stepped Curved Strip, the latter extended one hole rearwards by a second similar Curved Strip. The securing Bolts help to fix another $3\frac{1}{2} \times 2\frac{1}{2}$ in. Flanged Plate 9 between the sides, while the rear ends of the Curved Strips at each side of the model are connected by a $3\frac{1}{2}$ in. Strip 10, attached by Angle Brackets. The Bolt fixing the Strip to each Angle Bracket also holds an Obtuse Angle Bracket 11 and a $4\frac{1}{2}$ in. Strip 12 in place, the Brackets at each side in turn being connected by a $3\frac{1}{2}$ in. Strip, the securing Bolts also holding two Fishplates 13 in place. Flanged Plate 9, incidentally, serves as the seat, the back of which is provided by a $3\frac{1}{2} \times 2\frac{1}{2}$ in. Flexible Plate, attached to Plate 9 by Angle Brackets.





Above: An underside view of the 3-wheeler showing the simple, but strong chassis construction.

Left: Like the real Bond Bug, access to the Meccano 3-wheeler is by hinging forward the entire cab section of the body.



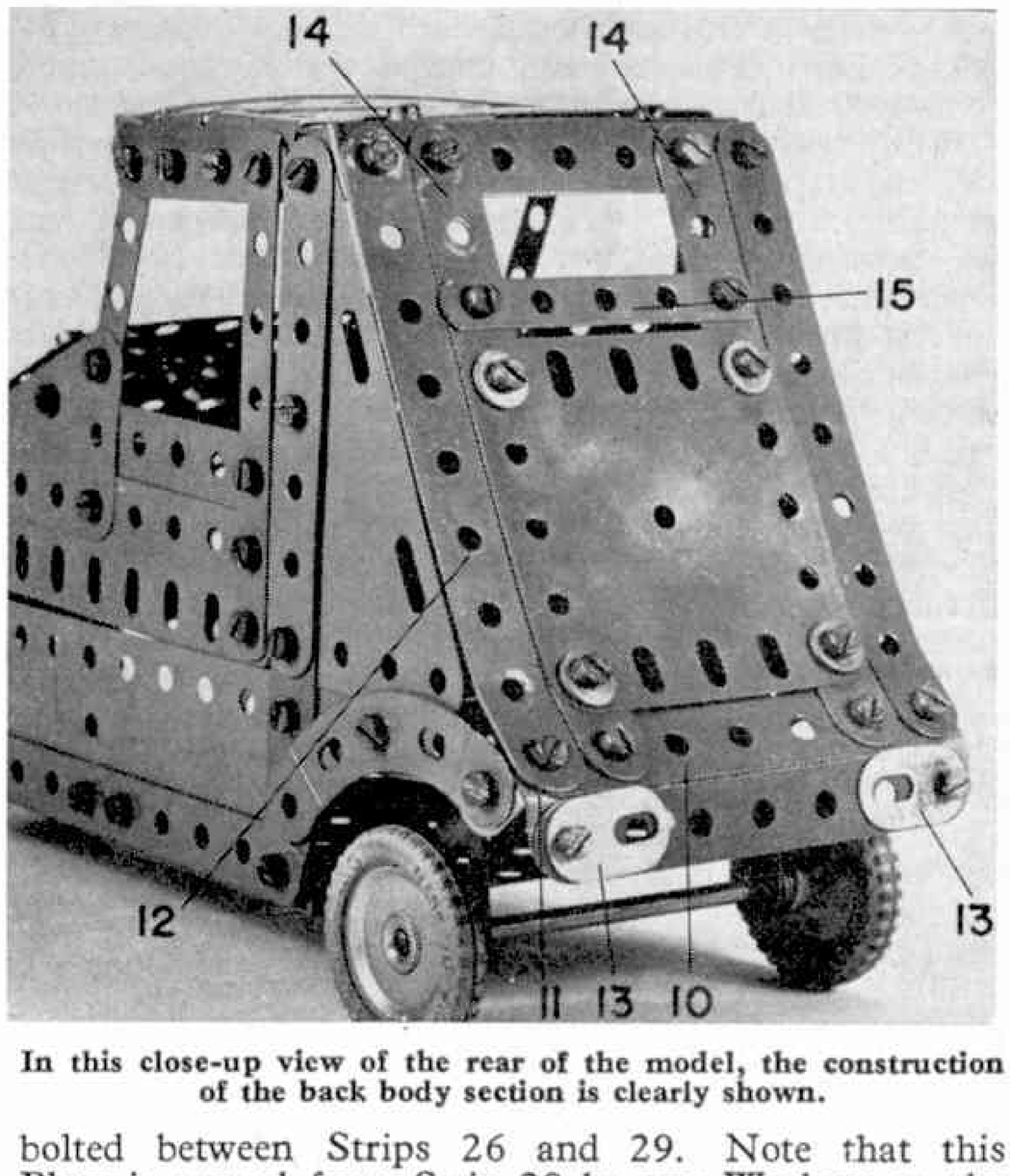
A close-up top view of the model, partially dismantled to show the Pinion-and-Worm steering linkage.

Two further $4\frac{1}{2}$ in. Strips 14 are secured through the second and sixth holes of Strip 10, a $2\frac{1}{2} \times 2\frac{1}{2}$ in. Flexible Plate and a $2\frac{1}{2}$ in. Narrow Strip 15, being bolted to these Strips to enclose the back of the model. At the sides, a $3\frac{1}{2} \times 2$ in. Triangular Flexible Plate 16 is bolted to each compound strip 7, in the position shown, the upper securing Bolt fixing a $3\frac{1}{2} \times \frac{1}{2}$in. Double Angle Strip between the top ends of the compound strips at each side. A $3\frac{1}{2}$ in. Strip 17 is secured to this Double Angle Strip by Angle Brackets, the lower securing Bolts also fixing the top ends of Strips 14 to the Double Angle Strip. Note that the Angle Brackets are opened out slightly to coincide with the sloping back of the model.

The centre-point of upper Double Angle Strip 6 is next connected to the centre of Double Angle Strip 7 by a $2\frac{1}{2} \times \frac{1}{2}$ in. Double Angle Strip 18, in the centre hole of which a 1 in. Rod is journalled, held in place by a $\frac{1}{2}$ in. Pinion 19 above the Double Angle Strip and by a Large Fork Piece below the Double Angle Strip. The lugs of the Fork Piece are extended by Fishplates, in the ends of which a 1 in. Rod is mounted, secured by a Collar and a 1 in. Pulley with Motor Tyre 20 between the Fishplates. In mesh with Pinion 19 is a Worm on a 3 in. Rod 21 journalled in upper Double Angle Strip 6 and Double Angle Strip 7 and held in place by a Collar and a Universal Coupling 22. Fixed in the other end of this Universal Coupling is a $2\frac{1}{2}$ in. Rod 23, journalled in an Obtuse Angle Bracket bolted to a 2 in. Strip which is, in turn, bolted to the lug of a 1×1 in. Angle Bracket secured to Flanged Plates 1. A $1\frac{3}{4}$ in. Steering Wheel is mounted on the end of the Rod.

Like the front wheel, the rear wheels are also supplied by 1 in. Pulleys with Motor Tyres mounted on a $3\frac{1}{2}$ in. Rod journalled in the end holes in the lugs of a $2\frac{1}{2} \times 1\frac{1}{2}$ in. Double Angle Strip 24 secured to the underside of Flanged Plate 9. Note that the Double Angle Strip is spaced from the Flanged Plate by a Collar on the shank of each securing Bolt, while each Pulley is spaced from the lug of the Double Angle Strip by three Washers.

Returning to the front of the model, two Obtuse Angle Brackets are secured through the second and sixth holes of upper Double Angle Strip 6, these Brackets each being extended by a further Obtuse Angle Bracket 25, the securing Bolts also fixing a $3\frac{1}{2}$ in. Strip 26 between the former Brackets. Bolted to the free lug of each of the latter Brackets is an ordinary Angle Bracket, to the free vertical lug of which a Collar 27 is attached by a $\frac{3}{8}$ in. Bolt to represent the headlamps. Bolted to each end of Strip 26, but spaced from it by a Washer, is a $2\frac{1}{2}$ in. Strip 28, the upper end of which is bolted, along with a $3\frac{1}{2}$ in. Strip 29 and a Hinge 30, to an Angle Bracket secured to the top rear corner of upper Triangular Flexible Plate 4. Two $1\frac{1}{2}$ in. Strips 31 are bolted, in the positions shown, to Strip 29, while the remaining space is enclosed by a $2\frac{1}{2} \times 1\frac{1}{2}$ in. Flexible Plate 32



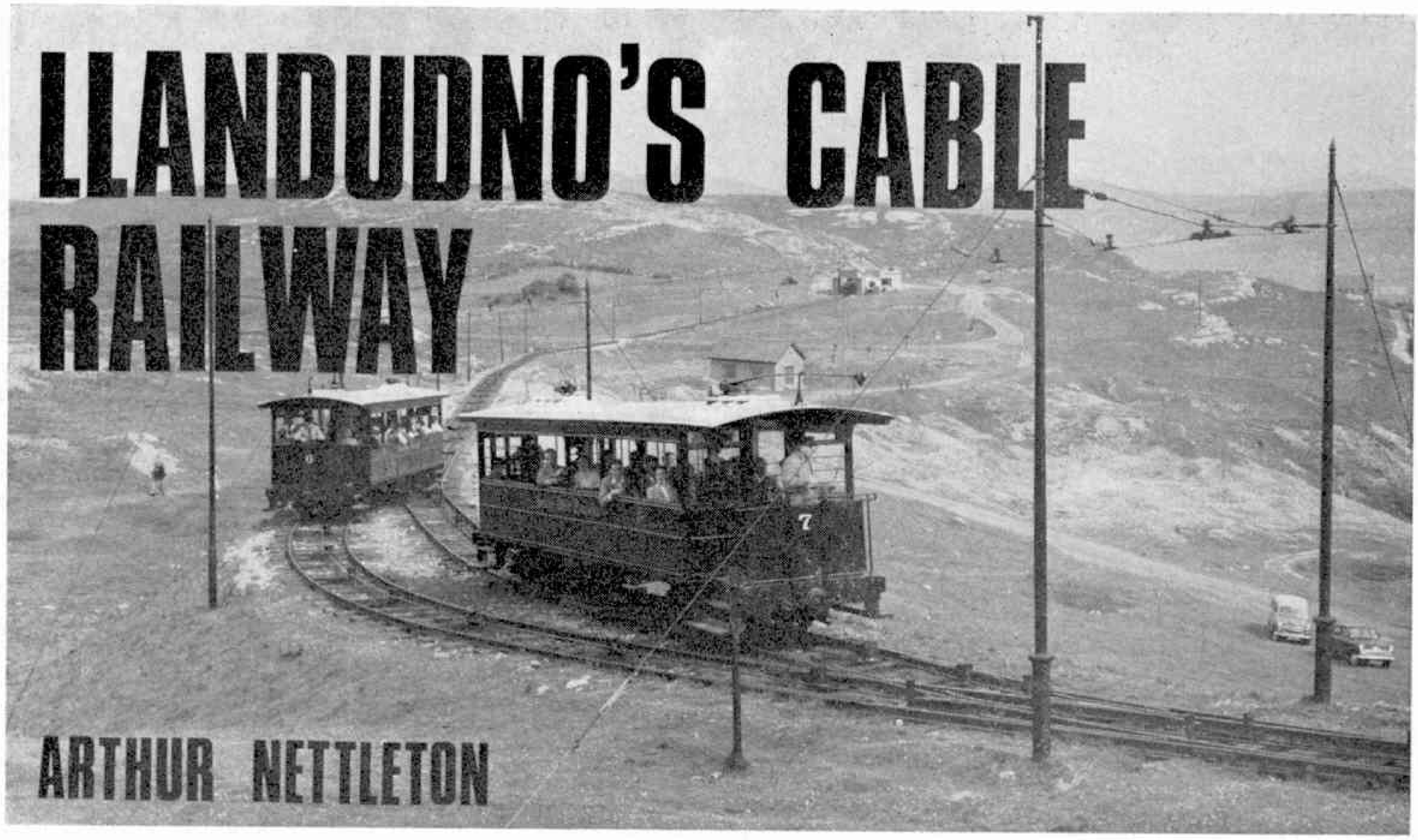
In this close-up view of the rear of the model, the construction of the back body section is clearly shown.

bolted between Strips 26 and 29. Note that this Plate is spaced from Strip 29 by two Washers on the shank of each securing Bolt.

This leaves us only with the opening cab section to complete. Each side consists of a $4\frac{1}{2}$ in. Flat Girder 33, to which a $2\frac{1}{2} \times 1\frac{1}{2}$ in. Triangular Flexible Plate 34 and a $3\frac{1}{2}$ in. Narrow Strip 35 are bolted. A $2\frac{1}{2}$ in. Narrow Strip 36, projecting upwards three holes, is secured to the upper rear corner of the Triangular Plate, while a $2\frac{1}{2}$ in. Strip is bolted to Narrow Strip 35. The upper ends of Narrow Strips 35 and 36 are

Continued at foot of page 84.

LLANDUDNO'S CABLE RAILWAY



ARTHUR NETTLETON

WHAT'S THE CORRECT NAME FOR THE PASSENGER TRANSPORT system which takes holidaymakers to the summit of the Great Orme, Llandudno, and which also provides a useful public service for inhabitants of the North Wales resort? Should this system be described as a railway or a tramway?

Don't be misled by the overhead wire and the trolleys on the car roofs. They do not carry electric power to the cars, but are for telephonic and bell communications only. In fact, although the power station (originally steam driven) is now electrified, the cars are hauled by cable and officially the line is a funicular *railway*, though it is often referred to as a tramway.

It is in two sections, each roughly half-a-mile long, with a change-over station at the halfway point, where passengers transfer from one car to another. This railway-cum-tramway is one of the most interesting in the world for other reasons, too, being comparable with the better-known system of the same type at San Francisco. Its steepest gradient exceeds 1 in 4, and the track runs to within 100 yards of the highest point on the headland.

A peculiarity of the Llandudno system is that it is a remote controlled railway running partly along public thoroughfares as well as on a reserved track. The only other place where an important cable-operated public railroad service runs in similar circumstances is Lisbon.

The idea of carrying a tramway up the Great Orme was first seriously considered nearly 100 years ago, the need for an amenity of this kind becoming apparent as Llandudno developed into a popular holiday resort and more and more houses appeared on the lower slopes of the promentory.

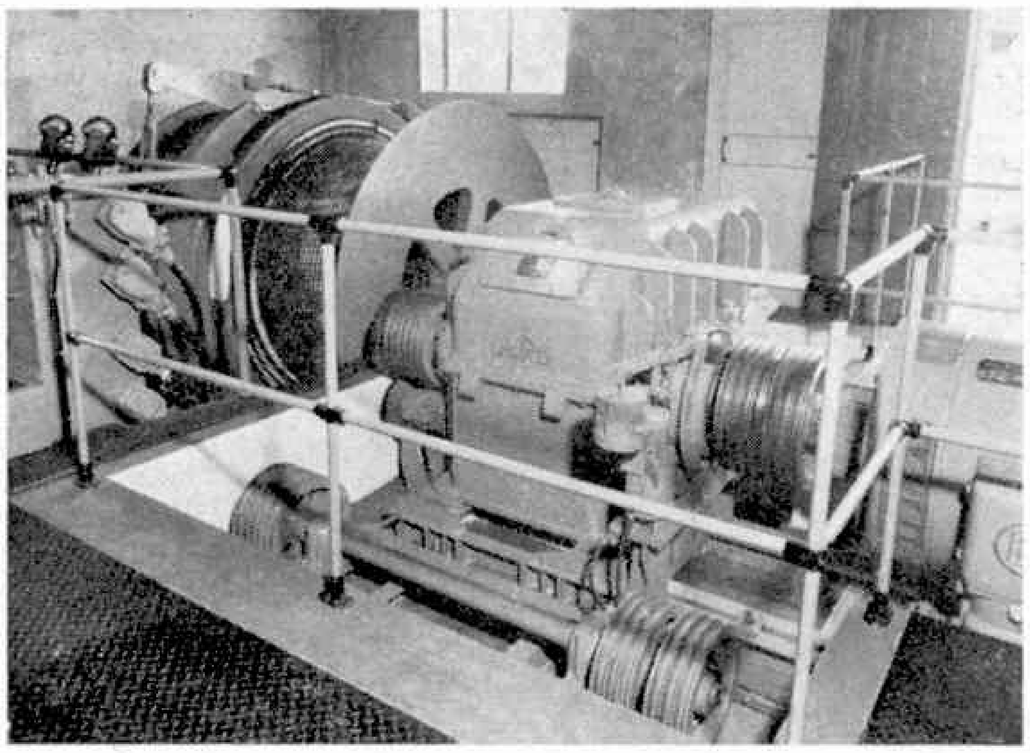
Yet the necessary legal preliminaries were not negotiated until 1898. In that year an Act of Parliament sanctioned the construction of a 3 ft. 6 in. gauge track to the top of the headland, using rails of an approved type, though the Act did not stipulate the kind of cars to be used, except to say that they must not be steam cars.

Another two years elapsed before sufficient funds to begin constructing the system were raised, and work did not start until April, 1901, when a beginning was made on the lower section. A number of problems further delayed the completion of this part of the line, one of these being a dispute about the use of land near the summit of the Great Orme, and the section from the foot to the halfway point was not opened until 31st July, 1902.

Oddly, there was no formal opening, the owners deciding to bring the railway into use as soon as the track and rolling stock had been officially declared safe for use by the public. Permission to open the line had, indeed, been granted only on the previous day!

The only concession to ceremony was the hasty mustering of the local bandsmen to play the National Anthem as the first car moved off. Not until 8th July, 1903, was the upper section brought into public use—again without any ceremonial events to mark the occasion.

Each section is fundamentally a separate funicular railway with its winding gear in a joint engine-house



Lower haulage showing the weight-operated pinion shaft brake and the pulleys and layshaft of the auxiliary vee-belt drive for annual overspeed test.

at the halfway point, and the cars are counterposed in pairs, the weight of each descending car helping to haul its partner up the incline.

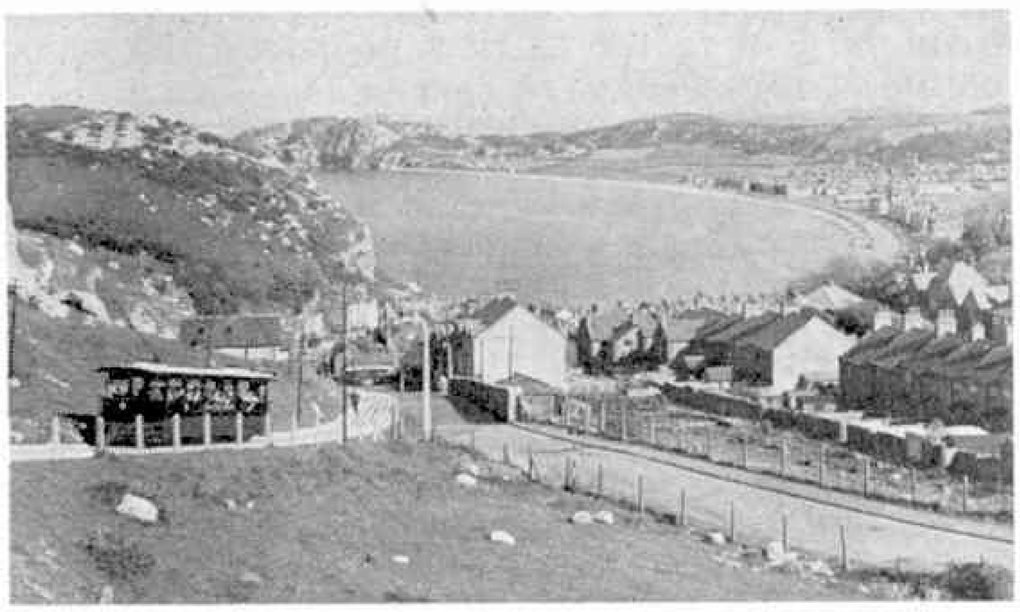
Two $1\frac{5}{16}$ in. steel cables, each half-a-mile long and with a breaking strength of twelve times the maximum load, are used on the lower section, while three cables $\frac{7}{8}$ in. in diameter work the upper stretch of line. One of these three cables goes from a winding drum in the engine-house, the second connects the two cars round a loose pulley at the rear of the car shed at the summit, and the third runs back to a second drum in the winding-house.

In its 70-odd years, this Welsh cable railway (or tramway) has had seven cars and four are in use today, though their livery has been altered from time to time.

Originally the sides were decorated in deep yellow and the roofs were white. But the yellow was later replaced by royal blue—an unwise step, as things turned out, the new paintwork eventually turning nearly black as a result of repeated varnishing.

So in 1962 and 1963 the old colour was stripped off and substituted by the original royal blue, using modern paint less likely to darken, and black linings were added to enhance the appearance of the cars still more. An even more attractive effect was achieved in 1967 when two-colour livery (cream replacing the blue of the upper parts) was introduced.

Another change occurred in 1934. Until that year the sides of the cars had borne the words "Great Orme Tramways," but that title was then altered to "Great Orme Railway."



As well as taking holiday makers to the summit of the Great Orme, the railway also serves a housing estate nearby.

Each car can seat 40 passengers back-to-back, and the interiors are painted dark brown with white ceilings. At first the open windows were screened with curtains, but these were abolished for the third season and have not been replaced, passengers preferring to have unobstructed views rather than increased comfort.

Three of the seven cars used on the system were employed for delivering coke to the engine house before the opening of the holiday season, 250 tons being consumed by the boilers each year. The passenger cars used today are Nos. 4, 5, 6 and 7 of the seven built for the line, and an entertaining fact is that holiday-makers riding in No. 5 nowadays are travelling in the very car which made the first trip on the lower section in 1902.

The freight cars have disappeared, but the passenger cars at present in use still retain the coupling and chain from the time when the coke vehicles were attached to them. Supplies were transported to the hotel at the summit in the same way.

Including the 3 ft. 6 in. open platforms at each end, the passenger vehicles are 37 ft. long and run on four 21 in. cast steel wheels. With the full complement of passengers and driver aboard, the cars weigh ten tons.

The gradients on the line naturally call for effective brakes, not only for scheduled stops but for emergencies too, such as the breakage of a cable or drawbar. Emergency brakes are particularly necessary on the lower section of the line, where the incline is exceptionally steep, and different methods of braking were adopted for the two sections, the cars on the lower stretch of line being fitted with jaws which were released if the cable snapped.

The jaws immediately expanded to grip the Z-slot of the conduit rail, the weight of the descending car then tightening the grip and halting the car. This braking system proved adequate for thirty years, but for some reason it was removed from car No. 4 and reliance was placed on slipper and hand brakes. It was a tragic error, for on 23rd August, 1932, the drawbar broke as the car was descending the steepest gradient, causing the vehicle to run away. It left the rails and crashed into a wall, resulting in two deaths and many injuries among the passengers.

Following the accident the railway was closed for nearly two years, and before it re-opened in 1934 improved brakes were fitted to both No. 5 and No. 4 cars. The brake controlled their speed, a governor operating them if $6\frac{1}{2}$ m.p.h. was exceeded. If the speed rose above this, steel-toothed skids pressed on the road surface, halting the cars smoothly.

In addition to having this effective braking arrangement ready to come into operation automatically, the skids can be applied from the platform as well. Cars Nos. 6 and 7, which are used on the less steep upper section, are considered safe with slipper brakes. Cars 4 and 5 are not fitted with them because application of the slippers would remove some of the weight from the skid brake and reduce its effectiveness.

As a further safety precaution the cables are reversed from top to bottom once during their lifetime, because their extremities pass further over the pulleys than the centre parts.

Each cable is also replaced well in advance of its maximum estimated safe life—that is, every eight years in the case of the upper section of the railway, and after four years' service on the lower section.

Installation of the electrical equipment, in place of the steam driven winding gear, was carried out by the English Electric Co. during the winter of 1957-58,

and the service was ready for re-opening by the following Easter.

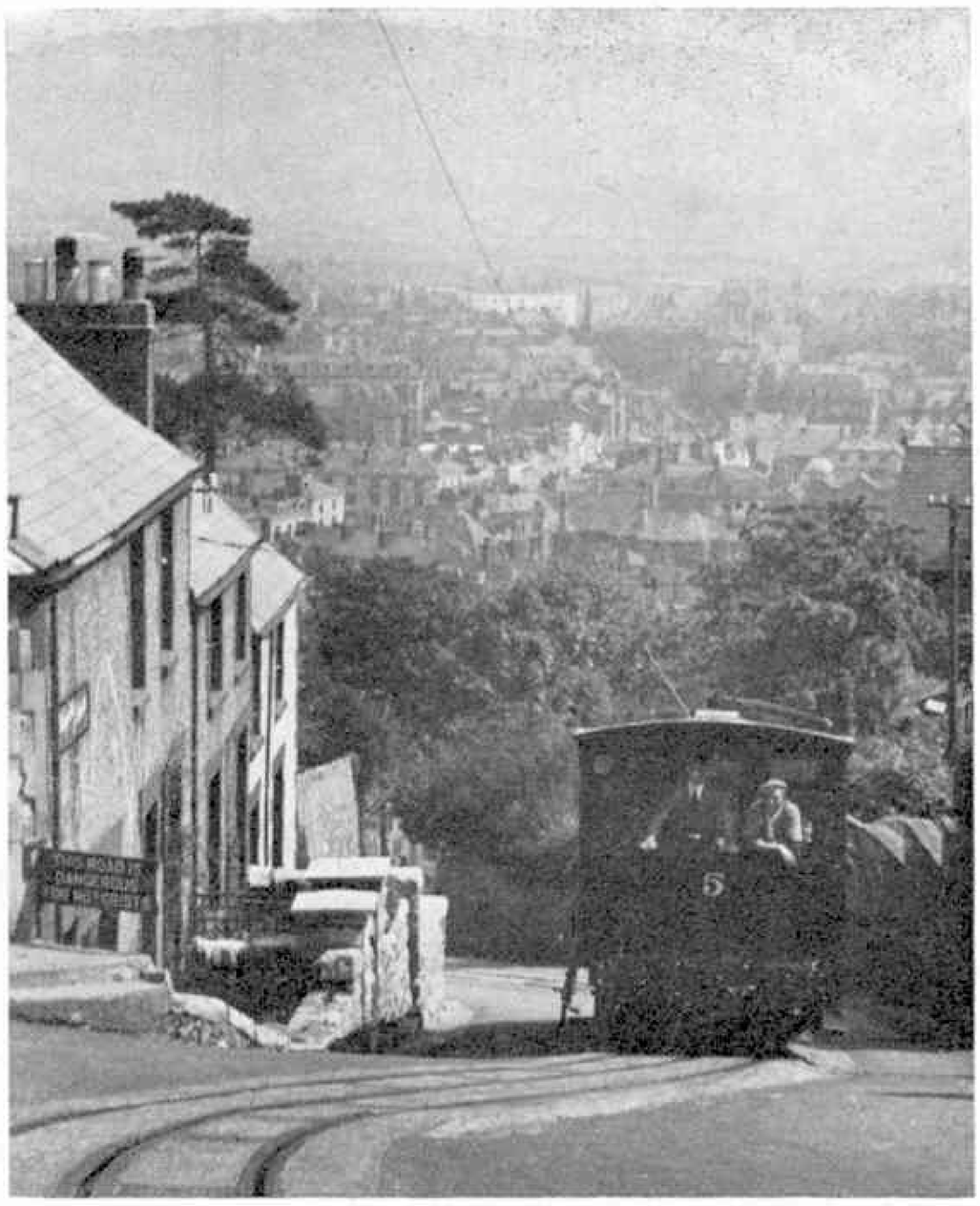
The drivers of the cars do not control the speed of these (5 m.p.h.) in normal circumstances, the rate of the cable-winding governing this of course. The drivers' chief job is to signal to the winding-house when the car is ready to start, or to apply the emergency brake if something untoward happens.

In addition to telephonic communication between the engineer in the winding-house and each car, by means of the trolleys and overhead wires, a system of bell signals enables messages about request stops to be passed to the engineer.

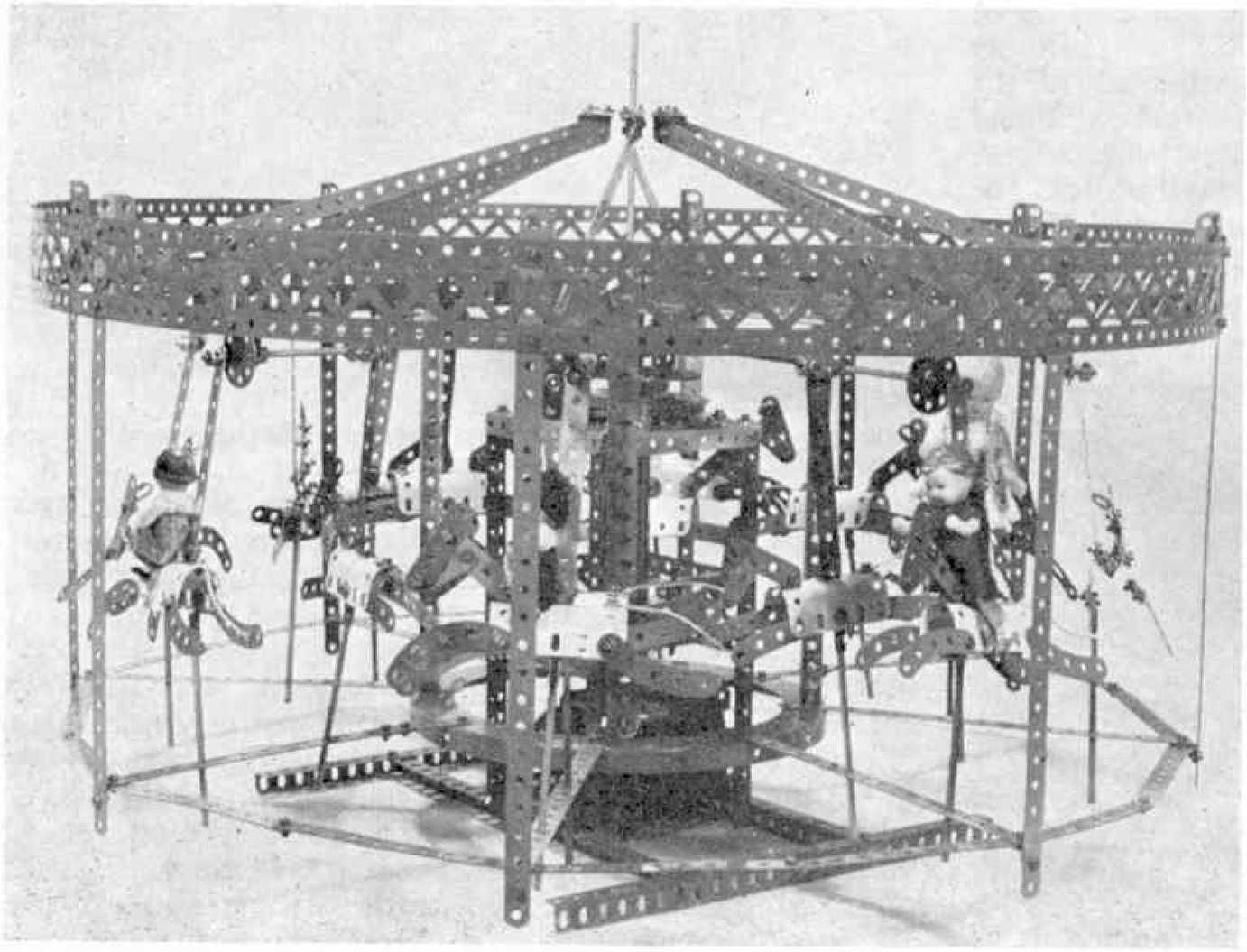
During its long lifetime this popular cable railway has carried an average of about 120,000 passengers each season, and although the summit of the Great Orme can now be reached by car or coach, the novelty of getting there by the earlier mode of travel has enabled the railway to continue prospering.

Yet its future was in jeopardy in the early 1930's. Claims for damages after the 1932 accident strained the company's resources, and the closure of the service seemed likely. It was saved from that fate when it was bought by six local men at the end of 1934, and it was ensured a longer life in 1948 by the Llandudno Urban District Council, who exercised a legal right to purchase the railway.

The attraction of the trip to the top of the headland lies partly in the views obtainable from this vantage point. For railway enthusiasts the Great Orme Railway has the extra allurement of being a system well worth studying for its history and engineering features.



The steepness of the gradient climbed by the cars is evident from the view of part of the route. Also shown is the cable conduit.

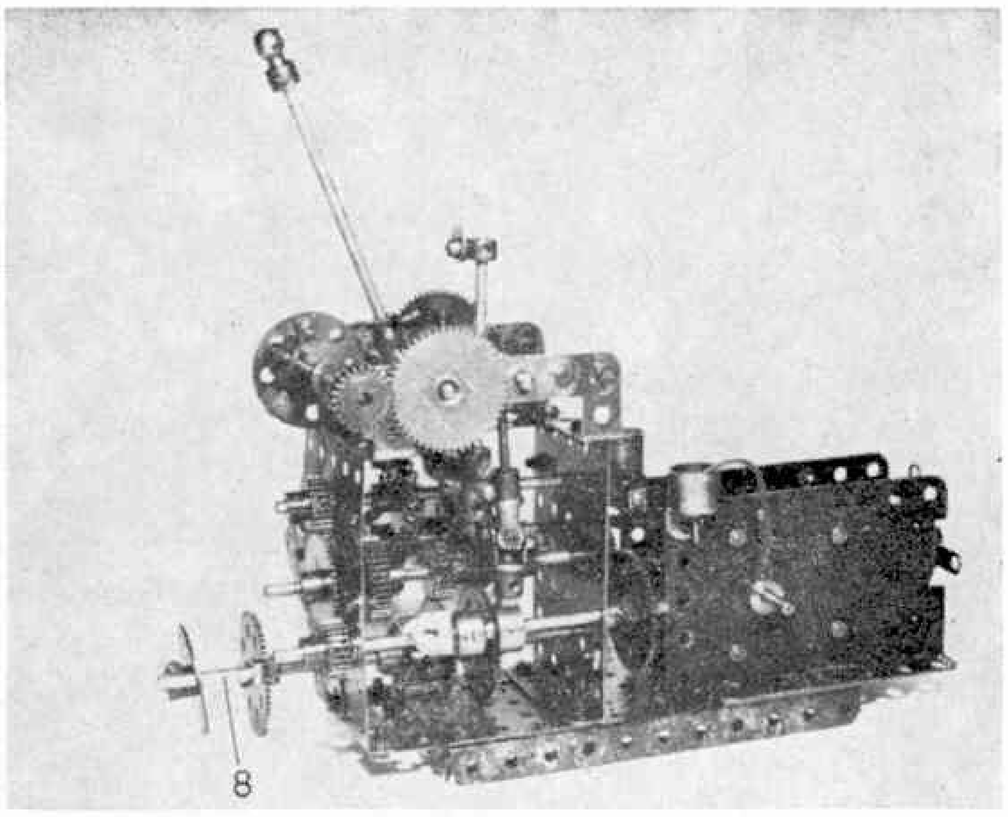


AMONG THE MODEL BUILDERS

with 'SPANNER'

NO EXPERIENCED MECCANO MODELLER WOULD DENY that some of the most useful parts in the Meccano range are included in the "Gears" category. Gearing, in fact, is often essential to the successful completion of many advanced models and, because of this, gearbox designs reproduced in these pages generally prove of particular interest to readers.

Undoubtedly, gearboxes to cover most conceivable requirements can be built in Meccano, but it is also true that many of the units which regularly appear have a slight drawback in that the selected ratio can not be locked in mesh and this can mean that the meshing gears sometimes tend to disengage when the gearbox is moved or tilted. Aware of the problem, Mr. V. N. Kitchin of Earls Colne, Colchester, Essex,

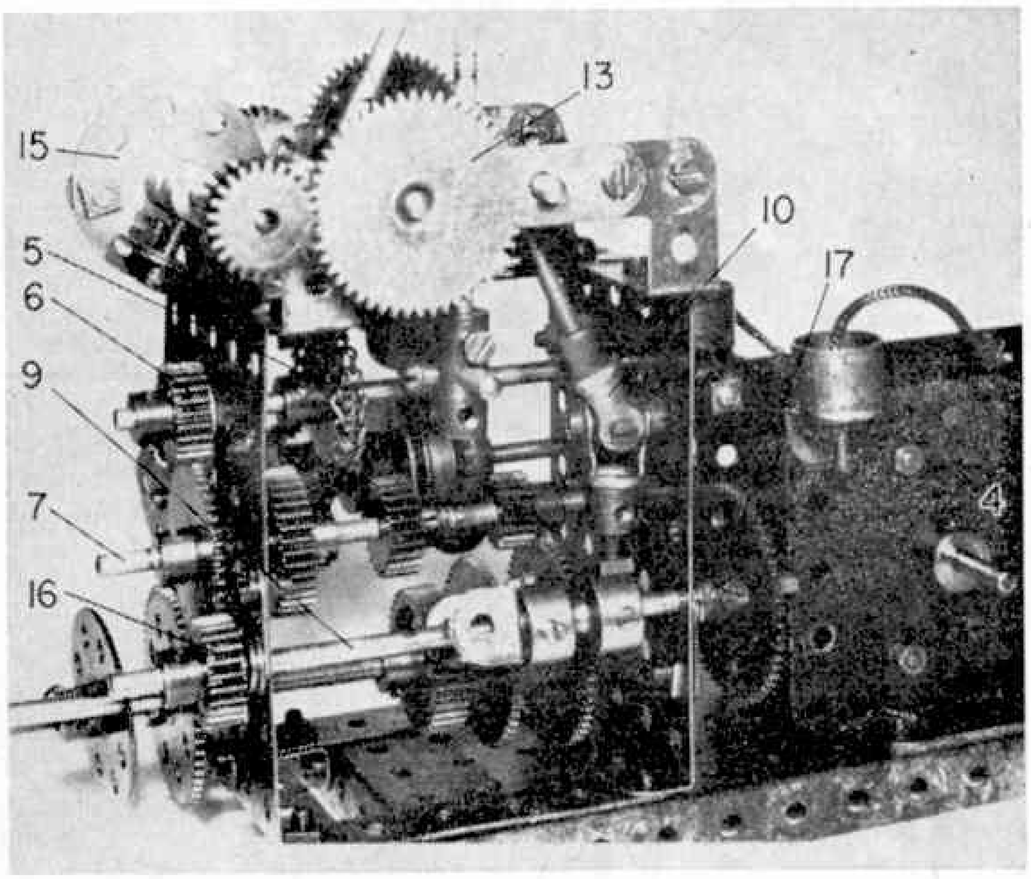


This 3-Speed and Reverse Gearbox, designed and built by Mr. V. N. Kitchin of Earls Colne, Colchester, Essex, incorporates a special retaining device which prevents the selected gears from slipping out of mesh.

has successfully overcome it in the 3-Speed and Reverse Unit, illustrated here, by gearing up a special retaining device to the gear-change lever. The device, itself, is simple, consisting of a Handrail Coupling, the head of which indents into the holes in the face of a sprung Bush Wheel, but I understand that it is highly effective when correctly adjusted.

The gearbox frame is built up from two $3\frac{1}{2} \times 2\frac{1}{2}$ in. Flanged Plates 1, joined together at top and bottom by two 3 in. Strips, the frame, in turn, being secured to a $5\frac{1}{2} \times 2\frac{1}{2}$ in. Flanged Plate, to which an E15R Motor is also bolted. A Worm on the output shaft of the motor meshes with a $\frac{1}{2}$ in. Pinion 2 on a suitable Rod journalled in a Double Bracket attached to the side of the Motor by a 1×1 in. Angle Bracket. Fixed on the end of the Rod is a 1 in. Pulley with Motor Tyre 3 which serves as one plate of a small clutch, the other plate being supplied by a $1\frac{1}{8}$ in. Flanged Wheel held in one end of a Socket Coupling 4, mounted on another Rod journalled in a Flat Trunnion bolted to one Plate 1. Fixed in the other end of the Socket Coupling is a $\frac{3}{4}$ in. Sprocket Wheel which is connected by Chain to a 1 in. Sprocket Wheel 5 on a 4 in. Rod journalled in the second-row-centre holes of Flanged Plates 1. Mounted on the end of this Rod outside the Flanged Plate is a $\frac{3}{4}$ in. Pinion 6 which meshes with a 50-teeth Gear Wheel on a 5 in. Rod 7 journalled in the centre holes of Plates 1. Also fixed on this Rod, between the Plates, are a 1 in. Gear Wheel, a $\frac{3}{4}$ in. Pinion and a $\frac{1}{2}$ in. Pinion. Situated immediately below Rod 7 is the sliding layshaft 8, supplied by a $6\frac{1}{2}$ in. Rod on which are mounted a 1 in. Gear, a 50-teeth Gear and a 57-teeth Gear arranged to mesh with the Gears on Rod 7, separately of course, depending on the gear ratio required.

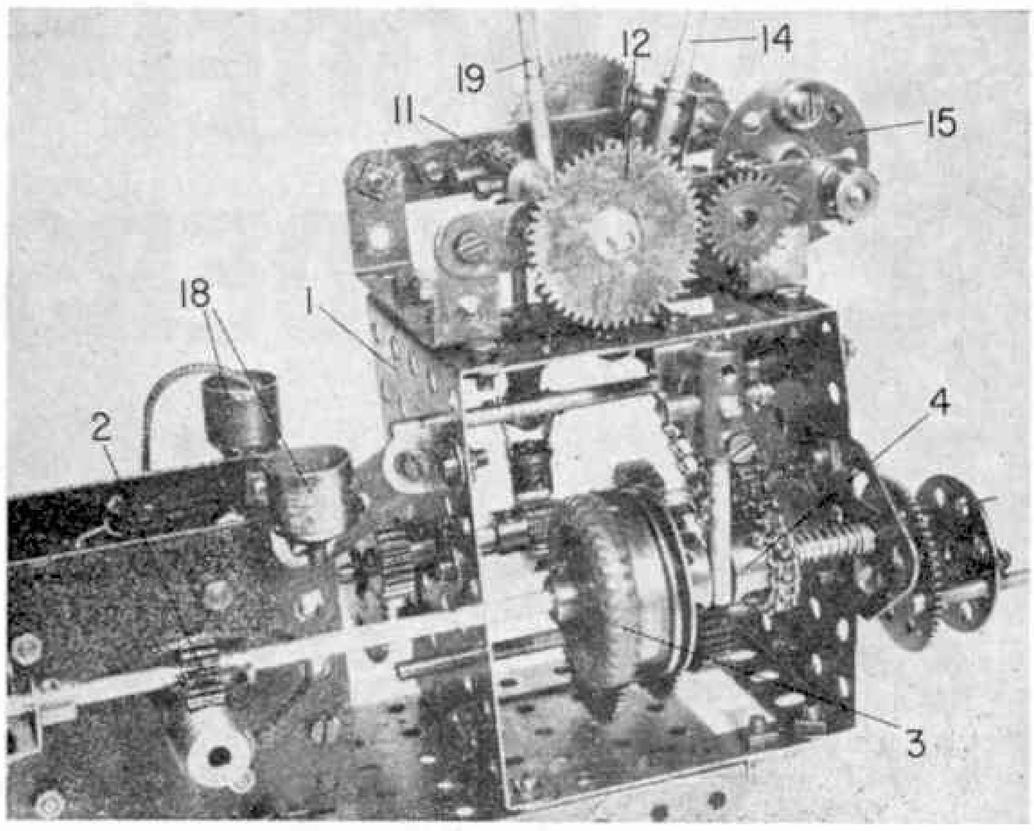
In Mr. Kitchin's original mechanism, movement of the layshaft is achieved by the forked end broken off a Small Fork Piece bolted to one lug of a Large Fork Piece, loose on another Rod 9 journalled in Plates 1, but fixed in one end of a Socket Coupling, also loose on the Rod. Fixed in the other end of the Socket Coupling, but loose on the Rod, is a Collar, in one transverse bore of which is fixed a Threaded Pin, on which a Universal Coupling 10 is loosely mounted. Fixed in the other end of this Universal Coupling is a short Screwed Rod, the top end of which is screwed



Another view of the Gearbox showing the standard 3-speed arrangement of gears.

into the centre transverse tapped bore of an ordinary Coupling 11, mounted on a Rod journalled in a suitable framework fixed to the top of the Gearbox casing.

Secured on the end of this Rod is a 50-teeth Gear Wheel 12 which meshes with a $\frac{3}{4}$ in. Pinion on another Rod journalled in the same framework, this Rod also carrying a Coupling and a further 50-teeth Gear Wheel 13. Carried in the longitudinal bore of the Coupling is a Rod 14, serving as the gear-change lever, while the Gear meshes with a $\frac{3}{4}$ in. Pinion on yet another Rod journalled in the same framework. Also mounted on this last Rod is the 8-hole Bush Wheel 15 incorporated in the earlier-mentioned restraining device. The Bush Wheel is itself free on the Rod, but is locked to a Collar fixed on the Rod, by two Fishplates, one on top of the other for strength, held by locked $\frac{1}{2}$ in. Bolts. One of these Bolts, of course, passes through the elongated holes in the Fishplates, allowing the Bush Wheel a certain amount of movement on the Rod. A Compression Spring is positioned between the Bush Wheel and the Collar to hold the Bush Wheel at the limit of its travel. A Handrail



A close-up view of the Gearbox showing the single-plate clutch. The clutch is controlled by a Rod engaging with Socket Coupling 4, the Rod being extended by a suitable linkage using Couplings and further Rods to the final clutch-control lever 19 protruding from the top of the Gearbox.

Coupling fixed to the side of the framework bears against the face of the Bush Wheel, its head locating in one or other of the holes as the gears are changed.

For reverse gear, Mr. Kitchin makes use of the Rod 9 carrying the layshaft control equipment. A ¾ in. Pinion 16 on one end of this Rod meshes with a 57-teeth Gear Wheel on the end of the layshaft, another 57-teeth Gear 17 on the other end of the Rod meshing with a ¾ in. Pinion on the end of Rod 7. As Mr. Kitchin points out, "These are not in the conventional horizontal or vertical line, but, if the load is not too great in reverse, this method is quite adequate."

This covers Mr. Kitchin's Gearbox, but there is one other feature of his original unit illustrated here, namely the Motor oiling system which, as Mr. Kitchin openly admits, he obtained from a very old copy of Meccano Magazine. The system consists quite simply of two Chimney Adaptors 18 fixed to the sideplates of the E15R Motor by Angle Brackets, using fibre washers with the Adaptor Bolts to prevent leakage. The Adaptors are filled with light oil which is simply transferred to the required points by lengths of wick cords—very simple, but very effective.

Roundabout

Also illustrated here is a neat, working model of a 16-horse "Gallopers" Roundabout designed and built by Mr. Bertram Powell of Halesowen, Worcs. "I have previously built several models like this one," writes Mr. Powell, "But differing slightly, some rotating on a roller bearing built up from Hub Discs and Flanged Wheels, but all driven from the centre, like your excellent model shown on page 504 of the September 1970 M.M. . . .

"In my present model here, this problem (and a few others!) has been solved by driving the model from a side shaft, at the top of which is a 1 in. Gear which engages a 3½ in. Gear Wheel on which the whole superstructure is mounted. Above the 3½ in. Gear is a Circular Plate and the two are joined by eight 1½ × ½ in. Double Angle Strips, through the centre holes of which the crankshafts are carried, each terminating with a ½ in. Pinion. These engage with a 1¼ in. Contrate Wheel which is fixed on a short Rod, itself fixed in a Face Plate screwed to the top of the central. (The "chimney" is another separate Rod which does nothing in particular!).

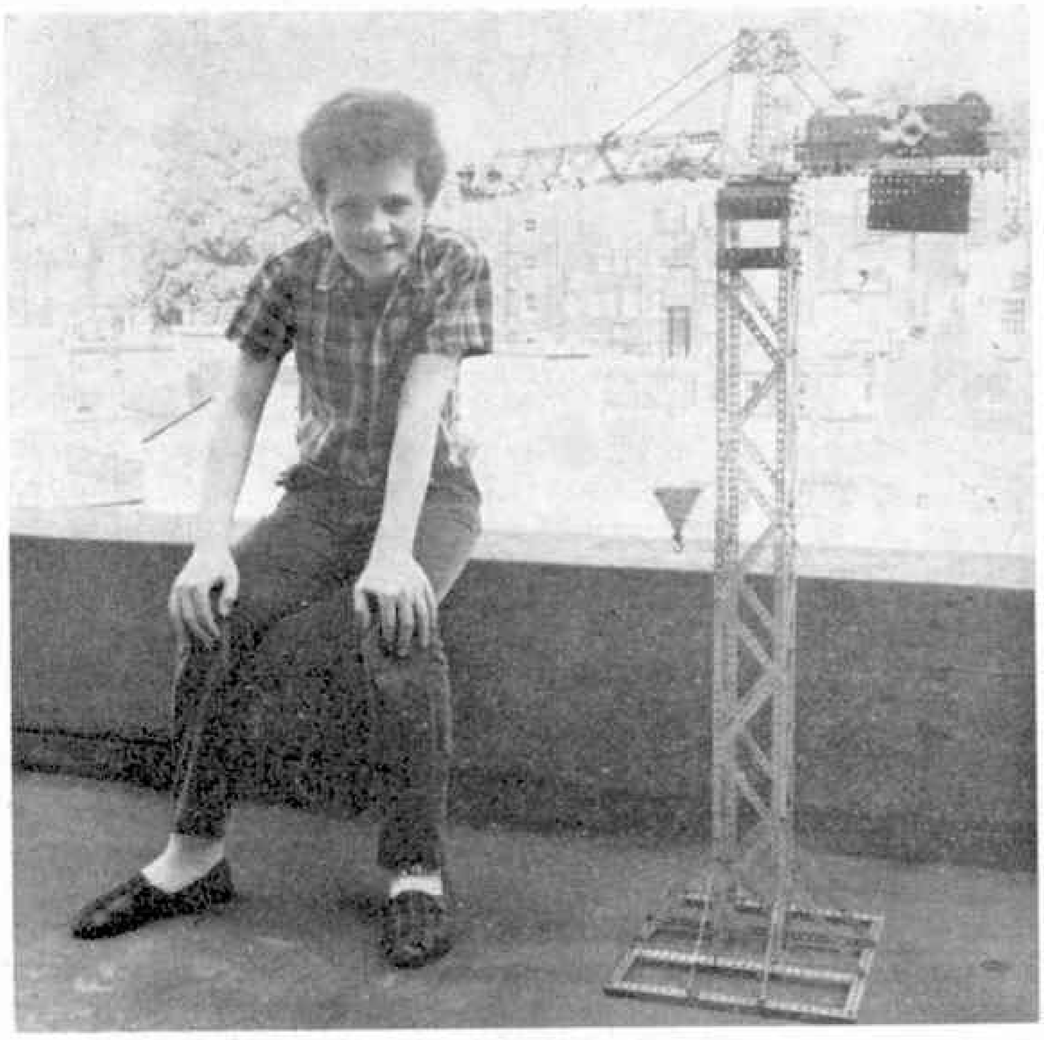
"The whole is driven by an E20R Motor (which could be replaced by an E15R Motor) at the bottom . . . with an overall reduction ratio of 590 : 1 which seems about right, but is easily adjustable."

Meccano Roundabouts are essentially "working" models and it is therefore difficult to show them off to their best advantage in a "still" picture. The accompanying illustration, while being good, still does not do full justice to Mr. Powell's model, but I have it on good authority that the pupils in the school where Mr. Powell teaches have passed it with flying colours!

Tower Crane

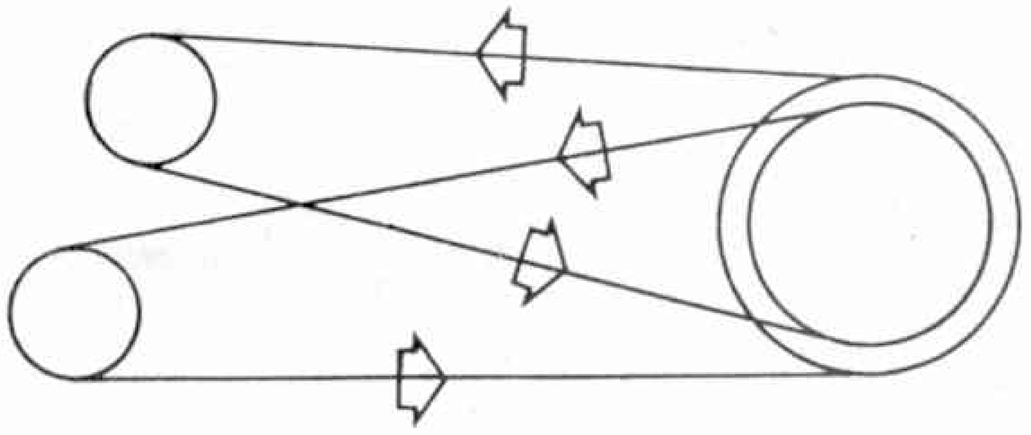
Described in last month's "Among the Model Builders" was a nicely proportioned Tower Crane which was constructed by young reader Carlos Reed of London. Unfortunately, space prohibited us from publishing the picture of young Carlos and his model so to keep the records straight, interested readers will find it reproduced at the top of the next coulmn.

I think all will agree that Carlos' model is extremely impressive.



Correction

On page 555 of the October issue we printed a diagram showing the method of winding the hoisting Chain on the model of Weston's Differential designed by Mr. D. R. Cowdrey of Aylesbury, Bucks. Owing to a mistake on our part, the diagram was incorrect, showing two separate loops of chain, whereas there should be only one endless length of Chain arranged as shown in the corrected diagram, reproduced here. We apologise for the mistake and hope that it did not cause too much trouble.



We have now selected the three winning entries in the Meccano puzzle contest which was outlined on this page in the December issue. 30/- worth of Meccano parts are now on their way to the three successful entrants whose names are listed below. The solution to the puzzle incidentally was given in "On the Editor's Desk" in the January issue.

1st. D. C. W. Fairclough, 16 Sutherland Road, Prescot, Lancs.

2nd. Ian Hammond, 4 Nottingham Road, Isleworth, Middlesex.

3rd. D. M. Simpson, 31 Haflingden Close, Harpenden, Herts.

AIR NEWS

by John W. R. Taylor

Sikorsky's Gunship Helicopter

MOST SIGNIFICANT OF THE NEW KINDS of combat aircraft evolved during the war in Vietnam is the gunship helicopter. In such rugged terrain, and against an elusive enemy, troops have to utilise the go-anywhere mobility of transport helicopters to carry them into action. The cost in both casualties and aircraft would be high if the gunships were not able to make the enemy "keep their heads down" while the troops were disembarking.

At first, this type of close support was provided by fitting machine-guns and rocket launchers to the ordinary UM-1B Iroquois helicopters used to carry men and supplies. Then the Bell Helicopter Company developed from the Iroquois the AH-1G HueyCobra —a slim two-seater using the same engine and rotor system but combining a top speed of 219 m.p.h. with a heavy armament. It proved so successful that the U.S. Army has ordered more than 1,000 'Cobras, while the U.S. Marine Corps is buying the new AH-1J SeaCobra version with a twin-turbine power plant.

The U.S. Army intended to replace the 'Cobra with the entirely new Lockheed AH-56A Cheyenne, designed to its specification for an Advanced Aerial Fire Support System (AAFSS). This stub-winged "chopper" was intended to carry a much heavier armament, at speeds up to 253 m.p.h., but the production contract for 375 Cheyennes was cancelled in the Spring of 1969.

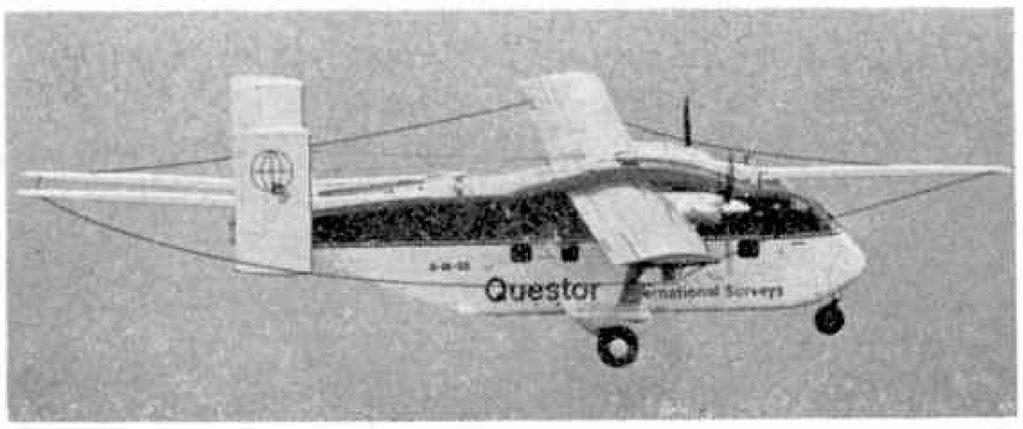
Lockheed are continuing development of the Cheyenne. Meanwhile, to fill the gap left by cancellation of the production order, Sikorsky have offered the U.S. Army their S-67 Blackhawk attack helicopter, of which they have built and flown a prototype at their own expense. This aircraft has a typical slim two-seat gunship fuselage, presenting a small target for enemy gunners, but embodies the well-proven General Electric T58-GE-5 engines and rotor systems of the Sikorsky S-61/Sea King series. The 28-foot-span wings not only offload the rotor in flight, and so help to give the S-67 a top speed of more than 230 m.p.h. in a dive; combined with the use of speed-brakes, an aeroplane-type tail fin and a controllable horizontal stabiliser, they make the helicopter highly manoeuvrable, so that it can take advantage of every scrap of cover close to the ground while approaching or leaving a target area.

With a maximum take-off weight of 22,000 lb., the Blackhawk is in the same general weight class as the S-61 series, and can carry up to 8,000 lb. of weapons and ammunition. Typical loads include wing-mounted rocket or TOW anti-tank missile pods and underfuselage and nose turrets housing either 7.62 mm. multi-barrel Miniguns, 20 and 30 mm. cannon or a 40 mm. grenade launcher. As a troop carrier, with modified cabin, it could transport 15 fully-armed troops at 165 m.p.h. in the upper section of a two-deck rear compartment, with fuel and ammunition below the floor. On rescue missions, it could fly 600 miles at high speed to recover as many as six persons. On reconnaissance or surveillance duties, it could carry electronic devices to detect and record the emplacement and movement of enemy personnel and installations.

The 1/10th scale Shuttlecraft mounted under a U.S. Army CH-54 helicopter.

When carrying troops, or external loads of up to four tons, the Blackhawk would not need the fixed wings, which are easily detachable, since weight-lifting rather than manoeuvrability would be the basic requirement. Another innovation is the use of sweptback tips on the rotor blades, to delay tip stall at high speeds, improve the blades' lift/drag ratio and reduce vibration stresses—all combining to give faster, smoother flight.

Whether or not the U.S. Army decides to order the S-67 Blackhawk, Sikorsky will gain a tremendous amount of valuable experience of high-speed helicopter design from simply flying the prototype.



The Short Skyvan built for Questor International Surveys of Toronto.

British Flight Aids for Russian Jets

Every time one of Aeroflot's big four-jet Ilyushin 11-62s touches down at Heathrow, on the airline's twice-weekly Moscow-New York service, it is met by a member of International Aeradio Limited who stows on its flight deck all the information that the crew will need for the transatlantic stage of their long journey.

The documentation, constisting of instrument approach and landing charts, radio navigation charts, and supplements giving the latest information on airports, radio communications and navigational aids, is delivered to Heathrow by radio-controlled vehicles from International Aeradio's headquarters at Southall. After the return flight from New York, the package is collected from the aircraft and amended as necessary to ensure that it is bang up-to-date before being put aboard the next aircraft on the route.

More than 400 other airliners are met each week at Heathrow and provided with a similar flight deck chart service, which brings in a great deal of money to swell Britain's export earnings.

Space Shuttle Tests

Scale models of the space shuttle vehicles that will one day help to deliver men and supplies to orbiting space stations at many thousands of miles an hour are making their first flight trials from a 127 m.p.h. helicopter.

The tenth-scale model shown in a picture overpage is 13 ft. long, with a wing span of 8 ft. and weight of about 600 lb. It is made of glass-fibre and aluminium sections which can be exchanged easily with other sections of different shapes to test various configurations. In the first drop on May 4, 1970, from a Sikorsky CH-54 Skycrane at 8,000 ft. over Fort Hood, Texas, the model demonstrated its ability to make a smooth transition to level cruising flight from the 60-degree nose-up attitude that will be adopted for re-entry into earth's atmosphere. After making such a transition, the full-size shuttle-craft will be able to land on an ordinary aerodrome runway.

The first test was followed by a three-month programme of drop-trials from a Skycrane at White Sands Missile Range, New Mexico. These included investigation of the Shuttle-craft's stability in stalled conditions and other factors that will help to ensure the safety of pilots who will one day fly the real thing.

Questor Skyvan

One of the strangest sights seen in British skies for many years has been the Short Skyvan light STOL (short take-off and landing) transport shown in the illustration on page 92. It was built by Shorts of Belfast for Questor International Surveys of Toronto, and will be used for geophysical survey work in Canada and elsewhere.

Seeming to carry its own perimeter fence, the twin-turboprop Skyvan has been modified by the addition of two 11½ ft. booms at the tail and an 8 ft. 4 in. boom at the nose. Strung between these and pylons under the wingtips is a loop of one-inch diameter cable which acts as a transmitter aerial for the aircraft's electro-magnetic mineral ore detection system.

The Questor Skyvan was flown over the Atlantic from Belfast to Canada in November, with the booms and aerial loop stowed inside its roomy cabin to reduce drag.

Russia joins ICAO

Early in 1970 the Soviet Union gave permission for a number of international airlines, including BOAC, to fly over Siberia and so reduce journey times between Western Europe and Japan. Now Russia has become the 120th member state of the International Civil Aviation Organisation, in company with most of the other airline-operating nations of the world except Communist China.

This move will greatly strengthen ICAO, as the Soviet airline, Aeroflot, is by far the biggest in the world, with 310,000 miles of air routes, serving 3,500 centres of population. It is estimated to carry about a quarter of all the world's air traffic, the target figures for 1970 being 80 million passengers, 350,000 tons of mail and 2½ million tons of air cargo. It also handles an immense variety of other tasks, ranging from icefield reconnaissance to forest fire-fighting and spraying crops with insecticide.

The seventh Skyhawk

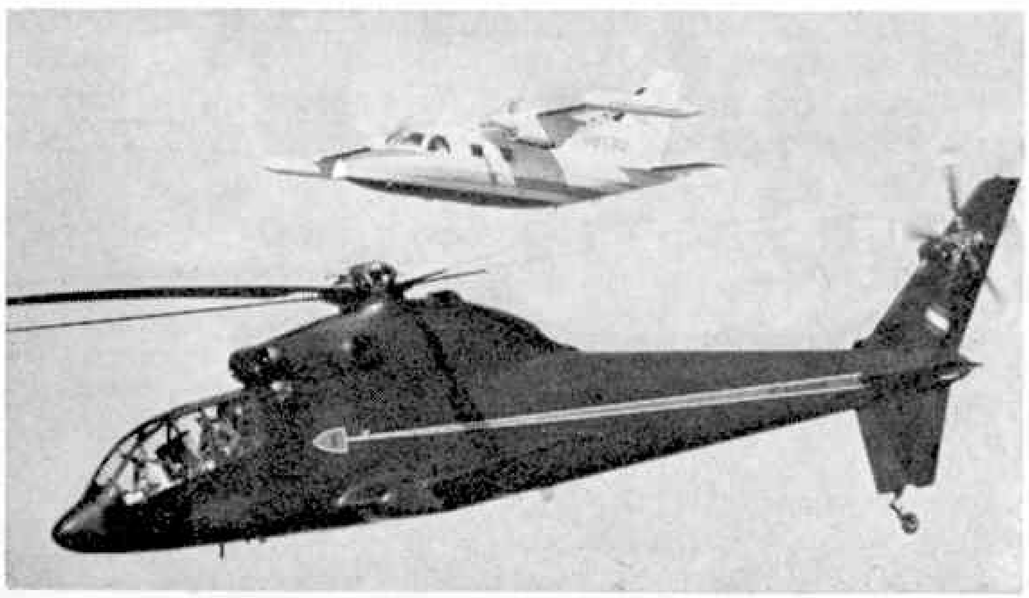
First flown on April 10, 1970, the McDonnell

The McDonnell Douglas A-4M 'Skyhawk' now powered by a Pratt and Whitney J52-P-408A turbojet.

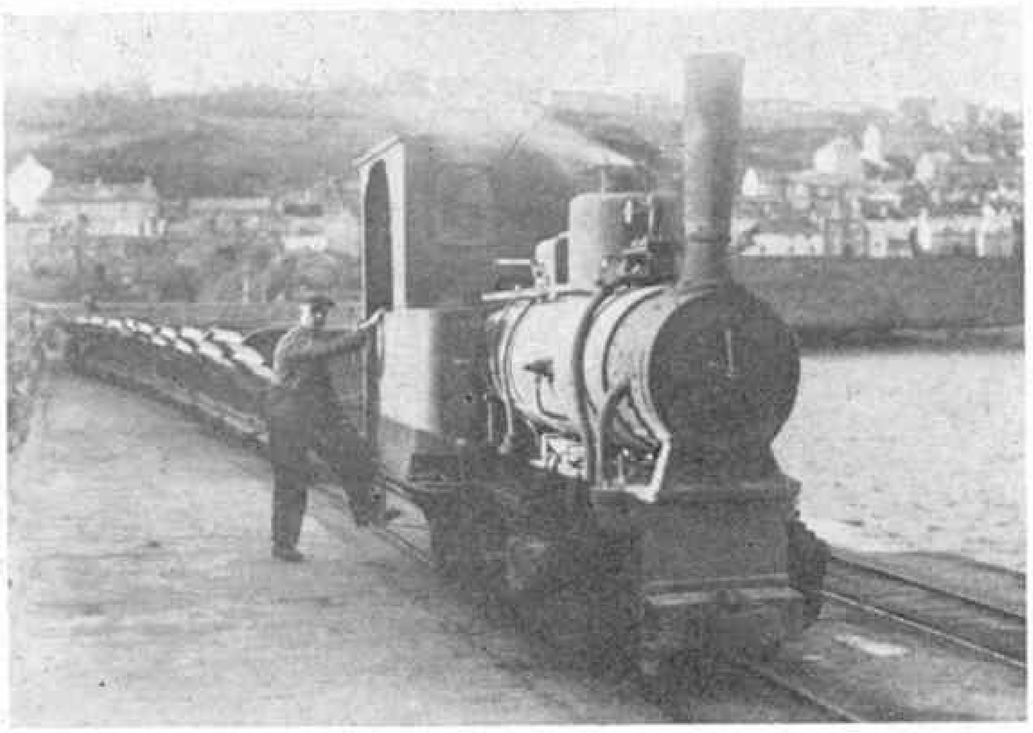
Douglas A-4M is entering service with the U.S. Marine Corps as the seventh major version of the Skyhawk light attack aircraft. The term "light" applies to its small size rather than its offensive power. Wing span is only 27 ft. 6 in. (so small that the wings do not need to fold when the Skyhawk uses aircraft carrier lifts), yet this "battling bantam" will carry up to 9,155 lb. of weapons, of every known tactical type, on four underwing attachments and one under its fuselage.

Power plant of the A-4M is a single Pratt & Whitney J52-P-408A turbojet engine giving 11,200 lb. of thrust, compared with the 9,300 lb. thrust of the engine in the earlier A-4F. The additional power increases the Skyhawk's manoeuvrability, rate of climb and acceleration and enables it to carry up to 744 lb. of advanced electronic equpiment to increase its efficiency and survivability in combat. Other new features include a drag parachute for short-field landings, a self-contained engine starter, increased headroom for the pilot and improved visibility from the cockpit.

Intended for operation from either forward bases ashore or carriers, the A-4M is following into service more than 2,400 other Skyhawks built by McDonnell Douglas since the type first entered U.S. Navy service in 1956. The Marines are currently operating the A-4C and A-4E versions afloat and ashore; the U.S. Navy has the A-4F in first-line duty on its attack carriers. In addition, Skyhawks are in service with units of the Argentine Air Force, Royal Australian Navy, the Israeli Air Force and the Royal New Zealand Air Force.



Sikorsky S-67 Blackhawk helicopter starts 5 degree dive leading to speed of 208 knots (239 miles an hour) October 19th near the Sikorsky plant at Stratford, Conn. In background is the pace aircraft, a Mitsubishi MU-2 owned by Bridgeport Flight Service and based at Bridgeport, Conn. Municipal Airport. Designed primarily as an attack helicopter, the S-67 is adaptable to a variety of military missions.



Penlee Quarries Steam Train (circa 1935).

CORNWALL'S STEAM HERITAGE

by Richard Angrove

Search out the history of steam in Cornwall when on holiday in the West country—the whisper and sigh of steam can still be heard in a few remote corners of the county

BETTER-KNOWN AS A TOURIST MECCA, when considering Cornwall most people conjure up a picture of yellow sands and surf-washed shores, but it is interesting to consider another and less-publicised aspect of this remote peninsula. This of course is Cornwall's unique contribution to the development of mining and the use of steam as a prime-mover. The two were synonymous, from the time the miners abandoned the recovery of metals from alluvial deposits by 'streaming' or 'panning' and started to excavate for minerals they were faced with the ever-growing problem of flooding. This stimulated the search for improved pumping techniques and the first steam engines were adopted to this work. But the early low-pressure engines were cumbersome and expensive on fuel and, with the nearest coal-fields some 200 miles distant, this was a constant worry.

The man who probably contributed most to over-coming these difficulties was Richard Trevithick. Many readers will be familiar with the story of his work on the development of steam traction. Known in the Southwest as the 'Cornish Giant' because of his huge stature, it was he, who by advocating the use of higher steam-pressure put Britain in the lead in the 19th century industrial revolution. Steam became the prime-mover in mills, mines, ships and on the railways. It thrust Britain forward on the crest of a wave of industrial prosperity such as the world had never known. His statue stands today outside the library at Camborne with a model of his first locomotive on his arm.

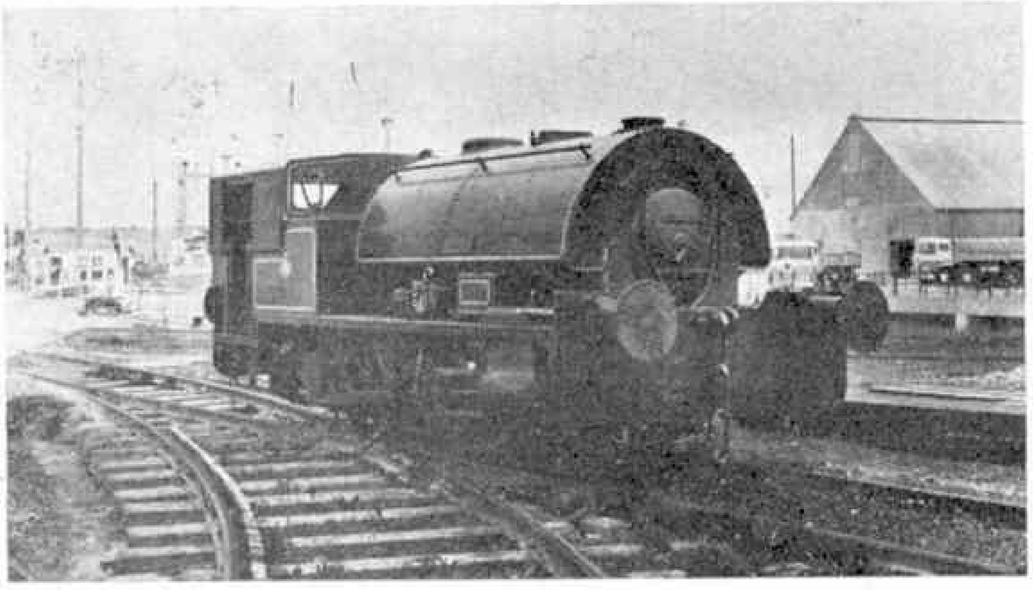
Across the road, housed in a museum of mining relics owned by the engineering firm of Holman Bros. Ltd., and open to the public there is a full-size working beam engine. It is operated by compressed air supplied from a portable compressor. The whole area is saturated with the history of technical developments. Murdoch astounded the populace of nearby Redruth with his first 'magic flame' from gas.

Watt installed his first engines at the mines surrounding the two towns, whilst a few miles away to the North, near Padstow is the birthplace of Sir Goldsworthy Gurney who, in the 1820s produced his celebrated 'steam coach' perhaps the most controversial of all vehicles. So, from the time, nearly 150 years ago, when the Liverpool and Manchester Railway was opened, the sounds and smell of steam spread to every corner of Britain. There can be few places in these islands which have not, at some time—perhaps only under certain climatic conditions—heard the first few exhaust blasts from a steam locomotive starting a heavy train.

Newton Abbot was one of the first West Region Sheds to go over entirely to diesels and from that time steam-haulage steadily declined in the West and over the whole of the B.R. network until, in August 1968 they ran their last standard-gauge steam-hauled train between Liverpool and Carlisle, ironically near the birthplace of railways in the 1820s. Thus closed a chapter of the steam saga but there remains a great interest in steam power. Thousands flock to traction engine rallies each summer and queue to ride on the 'Bluebell', 'Dart Valley' and other preserved systems.

In Cornwall however, in addition to a wealth of preserved relics in the way of beam engines and mining equipment, steam is still in daily use on two privately-owned systems. There is at Falmouth, owned and operated by the Falmouth Docks and Engineering Co., a standard-gauge system running three steam locomotives which handle some 50 pieces of privately-owned rolling stock in addition to marshalling large trains of general goods traffic. They are all 0-4-0s—one each from the stables of Hudswell Clarke (works No. 1632 built in 1929) Peckett of Bristol (works No. 1530 built in 1919) and a third which is the only survivor by cannibalising of four Hawthorn Leslies purchased in 1926-27. Admission to the docks is restricted but a panoramic view of the layout can be seen from the road overlooking the extensive berthing

Port of Par Railway 'Judy'.



area where a convenient parking recess is provided for observing both ships and trains.

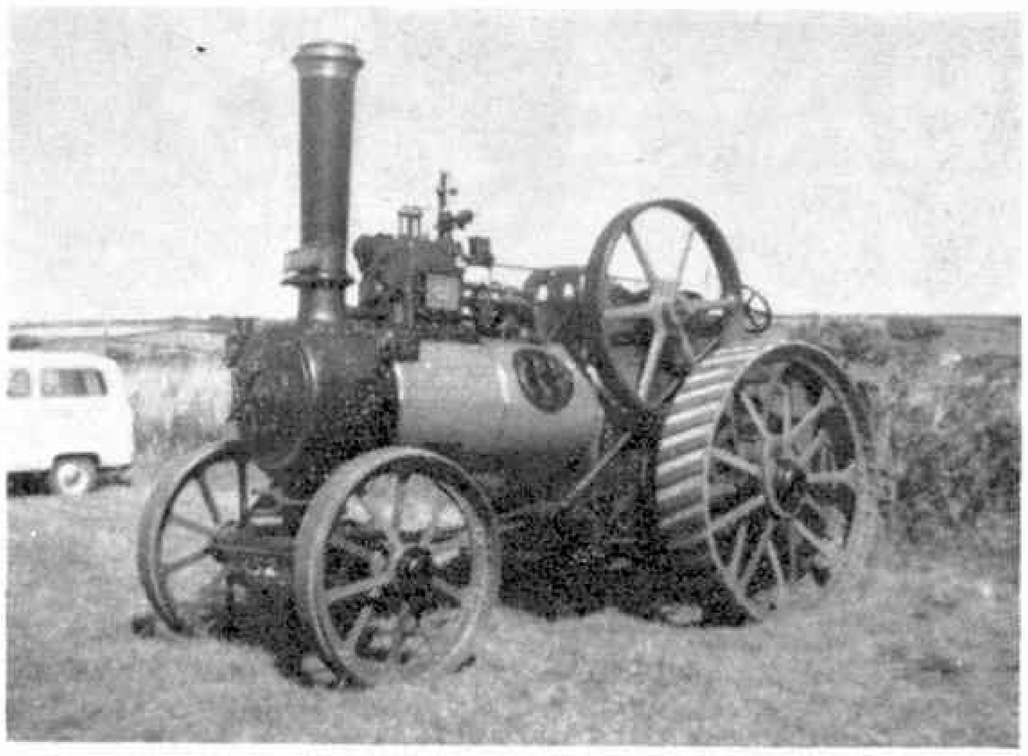
Further Eastwards, at the China Clay Port of Par the second standard-gauge system can be seen operating on most working days. Although no elevated vantage point is provided here, a good view can be obtained of the trains from the nearby main road. This railway is owned by the English China Clays group of companies who export one of Britain's largest and most valuable dollar-earning bulk-exports from here. From their extensive excavations and refineries in the immediate vicinity two million tons of China Clay are produced every year, nearly 75 per cent of which is exported. The port was created about 130 years ago to serve the tin and copper industry but in 1946 was taken over by the clay company who now run it as a subsidiary of the group.

Bulk clay for the potteries is handled by B.R. liner trains, about 800 wagons being currently allocated to this traffic but all marshalling in the dock area is done by their two steam locomotives 'Alfred' and 'Judy'. Judging by the obvious care lavished upon them both are held in high esteem. Both were built by W. G. Bagnell Ltd. of Stafford, 'Judy' (works No. 2572 was built in 1937) and 'Alfred' (works No. 3053) is a comparative 'baby' born as recently as 1953. In their shining livery of light-green saddle-tank and cab, framed in a broad yellow line, with brown under-

Port of Par Railway 'Alfred' hauling a line of wagons.

carriage, carrying the group's symbol and 'E.C.C. Ports' in gold and black—seen against the white back-cloth of china clay which envelopes the dock buildings, they present a visual treat to the steam lover rarely encountered in these diesel days. Because of low bridges within their operating area they are specially designed for a 7 ft. 6 in. head clearance. Initially this gives a somewhat stunted appearance but as one gets accustomed to seeing them an impression of streamlining and power is portrayed by the low dome and flat chimneys. They have a really robust exhaust blast which sounds most impressive re-echoing between the high port buildings as they happily haul 15 or 20 laden wagons around the extensive marshalling area—music indeed to the searching ear of the steam-lover !

Readers will know of Penzance being the end of the W.R. main line but few will realise that there is another and very active railway beyond the terminus. If your holiday takes you to this very Western end of Cornwall—and few visitors return from there without at least a 'flying visit' to Lands End—make a point of looking up this 2 ft. mineral railway at the extensive Penleee Quarries, between Newlyn and Mousehole about three miles West of Penzance. Owned and oper-



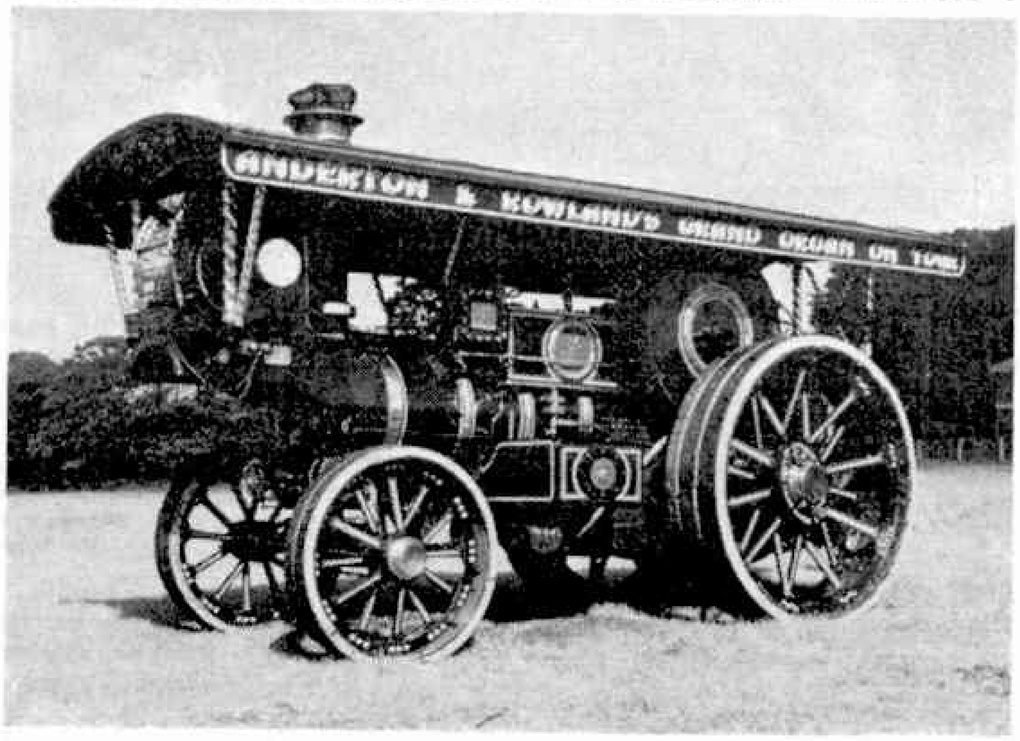
Ruston Hornsby 1935 Agricultural Engine.

ated by a branch of the Amalgamated Roadstone Corporation, traffic there is now handled by six Ruston Hornsby diesel locomotives. But, standing on a raised dais near the line is a German-built steam locomotive which, until 1941, handled all traffic. The system was then extended and diesel-traction introduced, had the changeover been more recently this unusual steam engine would probably have been welcomed into the fold of one of the many preservation societies but, alas! she has suffered the ravages of vandals and scrap metal hunters. Our photograph shows this historic locomotive in action over 30 years ago.

Many steam road vehicles too are preserved in Cornwall. The West of England Steam Engine Society stages an annual rally in the Camborne-Redruth area at the height of the summer holiday season. In addition to a show of veteran and vintage cars, about 50 steam vehicles take part. These include several well-known Showman's engines such as "The Iron Maiden" which was the "Star" in the film of that name and the 7 h.p. compound Burrell "Gladiator" (illustrated) and many others.

So if you are in Cornwall this summer and the weather renders sunbathing and other activities impossible, try the less-crowded byways and search out some of the sounds and smell of steam and take a nostalgic journey back to bygone days when steam was the motive power throughout the land and Britain, through the inventive genius of Trevithick, Stevenson, Brunel and others led engineering progress throughout the world.

7 h.p. Compound Burrell Showman's Locomotive 'Gladiator'.



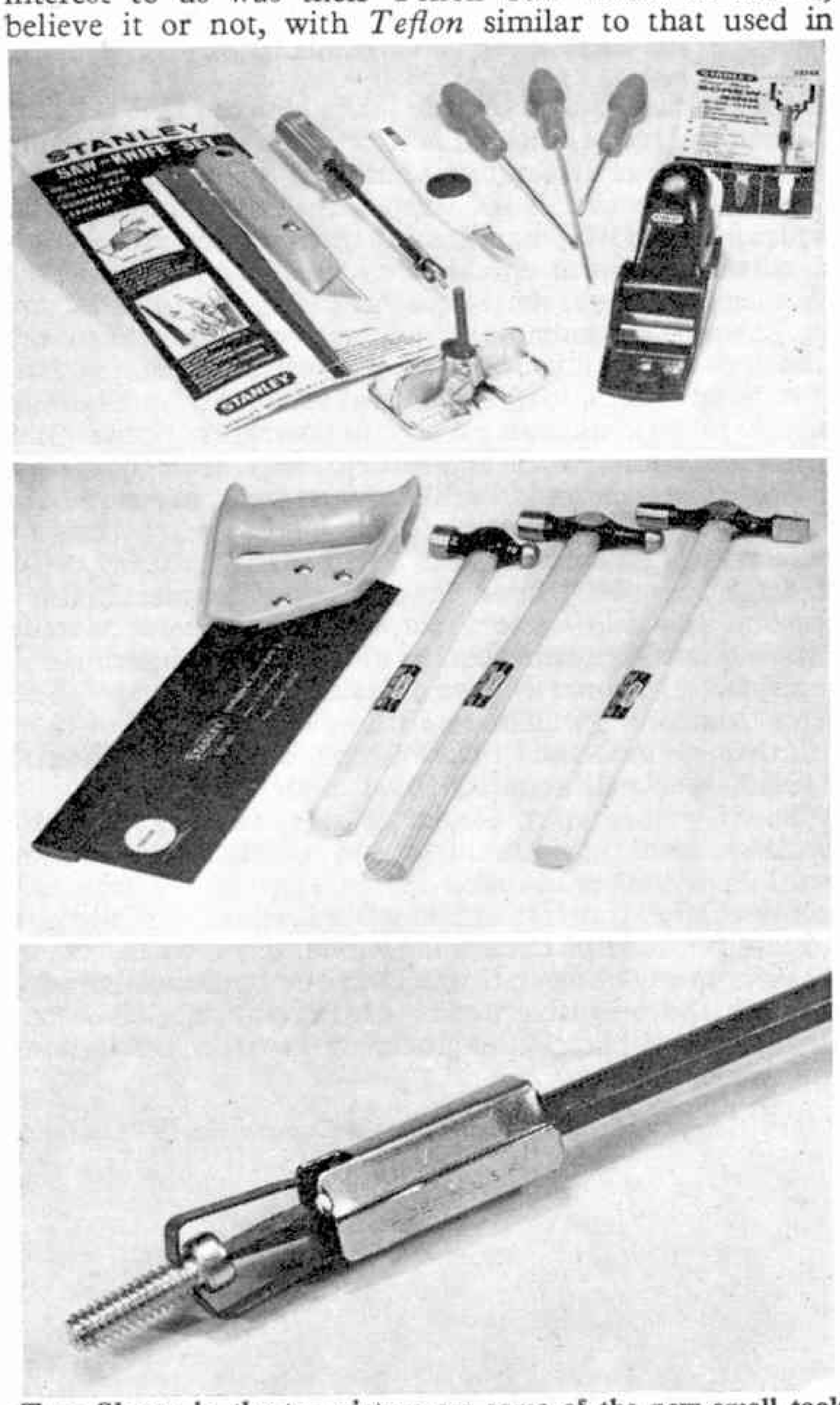
HAVE YOU SEEN ?

Stanley Tools

Most modellers, or so we have found, tend to be great " do it yourselfers " and we welcomed the opportunity to have a look at some of the fine tools produced by this famous company. Indeed, many of the tools shown in the accompanying photographs not only came in useful for various household jobs, but also are very useful in model making of all types. Of particular interest to us was their Tenon Saw which is coated, believe it or not, with *Teflon* similar to that used in the most up-to-date non-stick pots and pans ! This might seem rather strange at first, but when you use a saw which glides through wood without snagging or sticking, it turns out to be a very sensible and practical idea indeed.

Small hammers are probably the most widely used general tools and the most easily borrowed or lost, and Stanley sent us no less than three light hammers of various types and sizes which at present are being put to very good use in the construction of our model tank course for the Model Engineer Exhibition. The other photograph shows most of the beautiful small knives, screw-drivers and saws which will be of great interest to our modelling readers.

We were particularly impressed with one of the screw-drivers which had sprung loading jaws at the end for securely holding screws so that they could be inserted on the edge of the screw-driver blade and into the most difficult recesses. There are, of course, literally dozens of other small tools being produced at present by this company and we suggest that interested readers should either pop along to their local hard-ware shops or contact Messrs. Stanley Ltd., Stanley Works, Woodside, Sheffield, S39 PD, for further information.



Top: Shown in the top picture are some of the new small tools from Stanley which include saw-cum-knife set, a variety of small screw drivers, small plane, and an ingenious routing tool.

Centre: This unusual saw is coated with non-stick Teflon which ensures that it glides through wood without sticking, one of the most irritating situations that can arise with more conventional saws. The three lightweight hammers shown are extremely useful for many modelling and light weight do-it-yourself jobs.

Lower: This unique device fitted to what is otherwise a conventional screw driver will grip numerous small screws and hold the slots in their heads firmly in the screwdriver blade, ideal for getting screws into those awkward places that arise especially in modelling.

Tilley Go-torch

We have recently received from the Tilley Lamp Company Limited a splendid gas-blow torch with disposable butane cylinders, which can be used for a variety of jobs both in and out of doors. The standard outfit provides a very hot flame and, in addition, there are paint stripping and soldering bit attachments. We found the soldering iron attachment of imense use at the local pond-side for carrying out small soldering jobs to model boats. In fact, without this portable torch our boating activities for the day would have been finished.

Priced at £2.19.6 this torch is really a must for anyone involved in outdoor modelling activites.

New Corgi Models

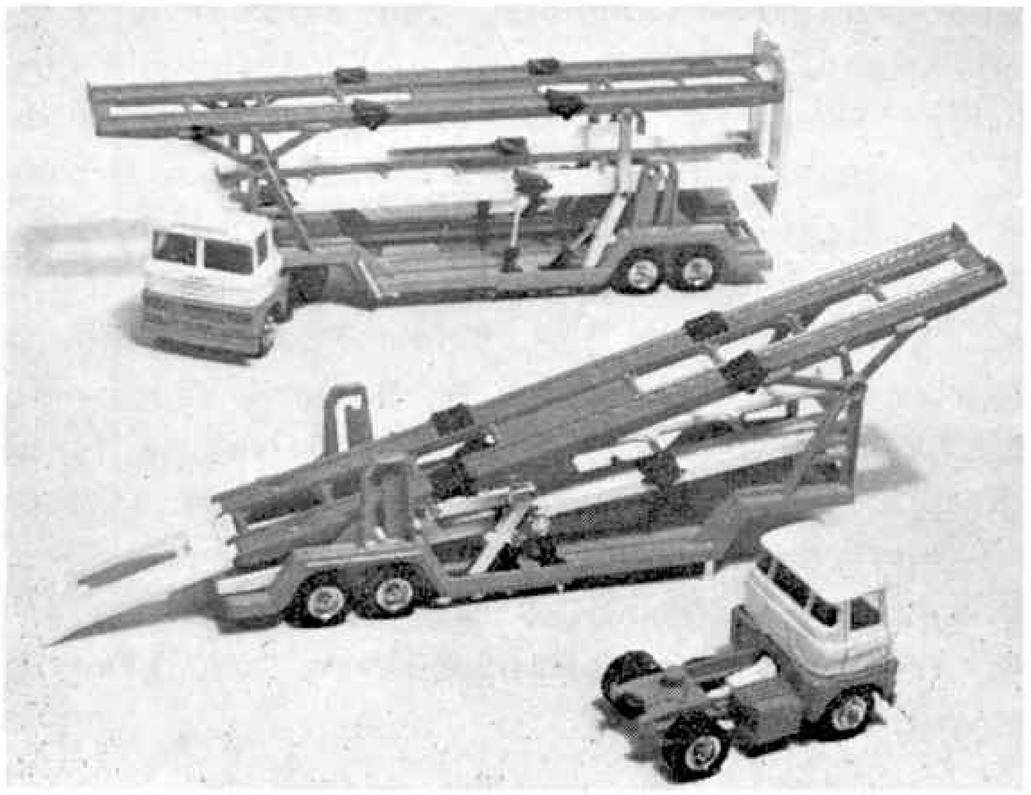
Three new Corgi models make an appearance this month, two heavy vehicles and a sports saloon. The most impressive of the trio is a new Corgi Major model of the Carrimore Tri-deck Mk. V Car Transporter. Featuring three loading decks, the top two of which can be raised and lowered as per the full-size vehicle, the model is one of the most ingenious die-casts we've seen for some time. It's truly large, measuring almost 12 in. from cab front to trailer car and apart from the cunning system of hinged supporting arms on the trailer is also fitted with a removable fully sprung cab section. Detailing and finish is superb throughout; headlights, fully independent suspension and a smart finish in chrome, white, orange and blue. Priced at 30/- it represents excellent value. The second vehicle to be introduced is another version of the popular Mercedes Benz 'Unimog' model, this time a 406 type with removable canopy. We've seen

Left: The 'Unimog' and right the 'Iso Grifo.'

the 'Unimog' before in slightly different guise, but nevertheless feel that readers should be made aware of the new one. The most impressive features of the models are its beautifully designed independent coil-spring suspension and the terrific amount of detailing such as wing mirrors, interior trim and complete underside parts which include fuel tanks and chromium plated axles, etc. Price of the 'Unimog' is 10/6d.

The final model from Corgi is of a super-luxury Italian sports car, the Iso Grifo Coupe. Finished in Metallic dark blue with a matt black bonnet, full interior details, opening doors and bonnet, and independent suspension, it retails at 8/11d.

The new 'Carrimore' shown in loading and road-going stages.



New Lone Star Flyer

Lone Star Products Ltd., will be introducing a number of new models in their 1971 Flyer range. One of these new models, the Corvette Sting Ray, will be available for delivery soon after Christmas.

The Corvette Sting Ray has a very interesting body shape with sculptured wings and a fast back. The die cast zinc alloy chassis incorporates the radiator grille, front bumper and the twin exhausts and like all Flyers is fitted with Lone Star's patented suspension and ultra fast running gear. Small studs on the chassis help to protect the free-running qualities of this model should it accidentally be trodden on.

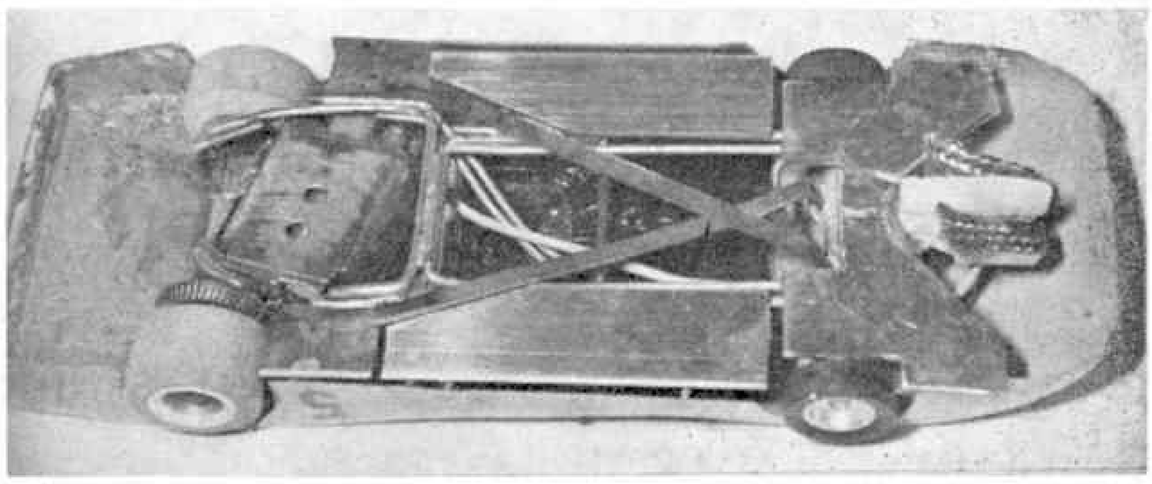
It has opening doors and bonnet (hood) and left-hand drive steering wheel, and the price of the model is 4/6d.

Mettoy Electrorockets

The fastest model car yet—that is the Corgi Electro-Rocket. Being introduced this month, the Electro-Rocket car employs a power-cell charged by plugging into a battery operated autocharger, realistically disguised as a petrol pump. An automatic timing device switches off the charge at the right moment.

The ElectroRocket is then placed on the track, a starter switch pressed and the resultant acceleration has to be seen to be believed. Tremendous speed is maintained for a considerable time, depending on the complexities and length of the circuit in use.

Initially, ElectroRockets are being offered with a Stunt Powerset which allows three different circuits to be devised. They include layouts with Spacehanger Bends, Superloops and Triple Loops. In addition, circuits can be extended by using components from the standard Corgi Rockets system. Can and autocharger can also be obtained separately. ElectroRockets hold all the fascination of ultra high speed, electrically powered and flexibility in layout. The prices are yet to be announced.



This is an issue of race reports; full photo and specifications coverage of the E.C.R.A. 1970 National Finals, the Tottenham Open Meeting, the Model Hobby Consortium Open Meeting and the British Championships at Nordic Park together with a report from Wonderland Raceways on their recent 24 Hour Event from this impressive list.

For collectors, there is part 2 in the Tootsietoy Saga together with Collectors' Corner by Cecil Gibson and Autominology by Reg Miles.

Model Cars

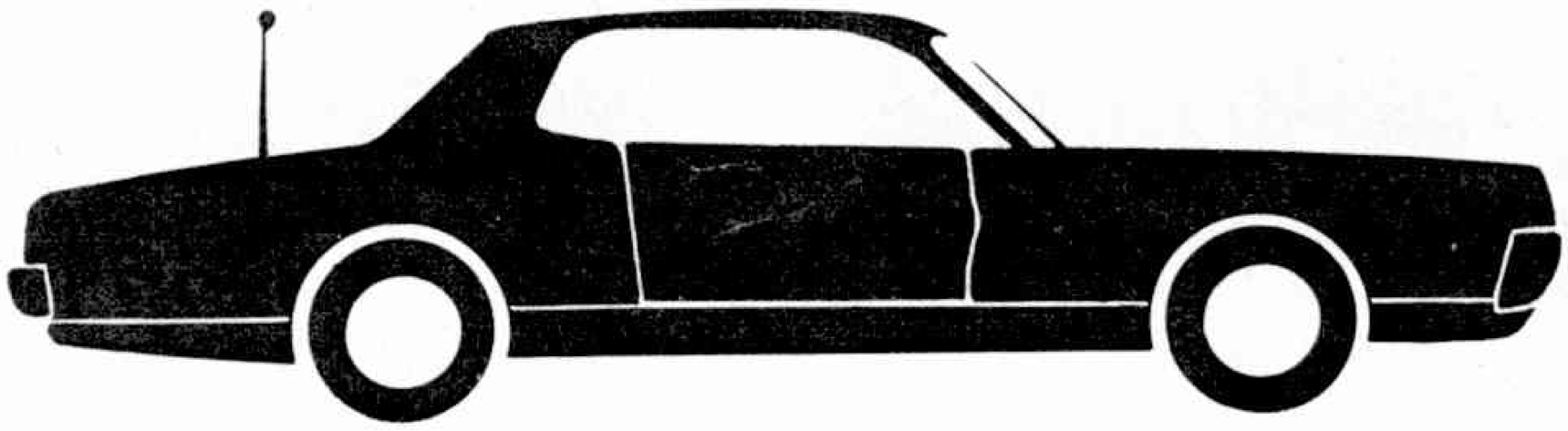
ON SALE NOW PRICE 3/-

car outline
COMPETITION
50 Dinky Toy Models to be Won!

Fill in the form opposite and simply send it in to *Meccano Magazine*, Comp', 13-35 Bridge Street, Hemel Hempstead, Herts., marked "Car Outline Competition" *or* if you don't want to cut your magazine just jot down your answer on a postcard and *don't* forget your address !

The first 50 correct entries received will be sent a model of the vehicle illustrated.

The vehicle illustrated is.....
.....
Name..... Age.....
Address.....
.....



DINKY TOY WINNERS !

Below is a list of the winners who correctly identified last month's silhouette and were the first to send their entries to the *Meccano Magazine* Office. To those of you whose entries were wrong, or didn't perhaps get them off to us quickly enough, don't despair, but have another try this month. The last month's car was, of course, an N.S.U. R.O.80.

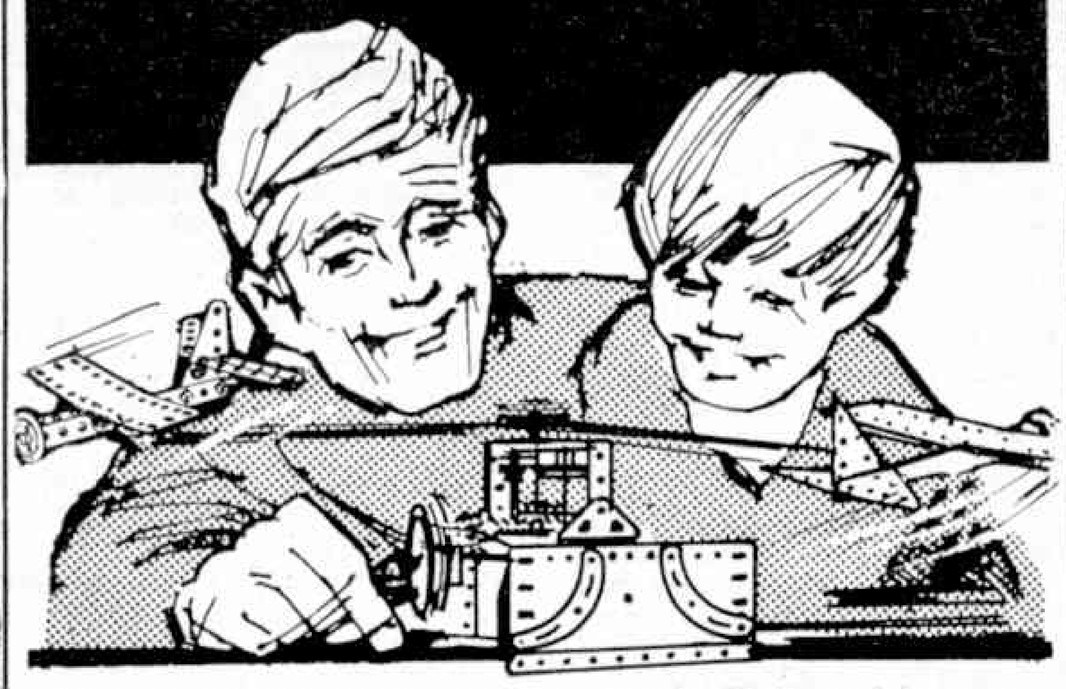
T. Baldwin, Wilmington, Devon. J. G. Ball, Stockport. M. Belcher, Reading, Berks. T. Blake, Cholsey, Berks. M. Botta, Bedford. T. Cain, Portslade, Sussex. J. Campbell, London S.W.11. P. Davey, Reading, Berks. M. Denning, Headley, Surrey. G. Dowle, Sidmouth, Devon. D. Dungworth, Sheffield. J. Duraton, Haverfordwest, Pembs. C. K. Edgley, High Wycombe. D. Eldridge, Ryde, I.O.W. A. Farren, Balsall Common, Warks. G. Favell, Birmingham. T. Franklin, Brighton. P. Fraser, Cowfold, Sussex. D. French, Dartford. K. P. Fullbrook, Stanford-le-Hope. A. G. F. Gillham, Boston, Lincs. M. Gilbert, Newark, Notts. N. Hedges, Chester-le-Street. J. Hedley, Hexham, Northumberland. R. Hoad, Hastings. D. Houston, Glasgow. D. Kirk, Leicester. C. Jones, Breinton, Hereford. P. Langhorn, Royton, Lancs. H. McFarlane, Loughton, Essex. R. Macauley, Highbridge, Somerset. J. Marriott, Wetherby, Yorks. M. Marshall, Hailsham, Sussex. I. Norman, Broadstairs, Kent. P. Northway, Dunfermline. A. Parkhurst, Blandford, Dorset. R. Parkin, Hertford. A. Paton, Glasgow. M. Prior, Malvern, Worcs. J. Pulsford, Scarborough. N. Rowens, Woolwich, S.E.18. J. Rowse, Altrincham. R. Salthouse, Manchester. I. Shergold, Reading, Berks. M. Stamp, Reading, Berks. M. Stlohm, Southend-on-Sea. D. Stuthard, Eastbourne. I. Tyne, Seaton, Devon. A. Williams, Stratford-upon-Avon. I. Wright, Hayes, Middx.

NEWS

MECCANO®

NEW

A Conversion Set gives INSTANT EXTRA MODEL IDEAS!



If you want more scope for building bigger and better models—extend your existing Meccano outfit by adding a Conversion Set. There is one to convert each of the first seven basic Meccano Sets to the next larger size. For the little cost of a Conversion Set you can make approximately 15 more models. It's so easy . . . . and you can go on adding to your Meccano outfit with the next Conversion Set. Extra parts mean bigger models and more fun!

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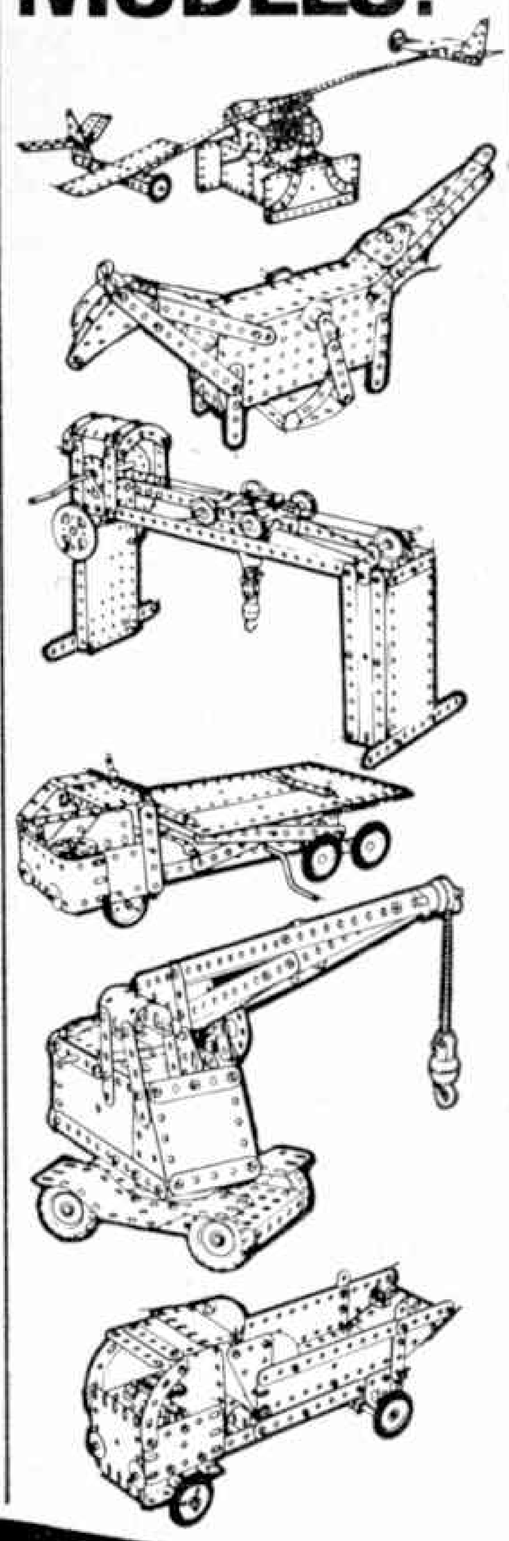

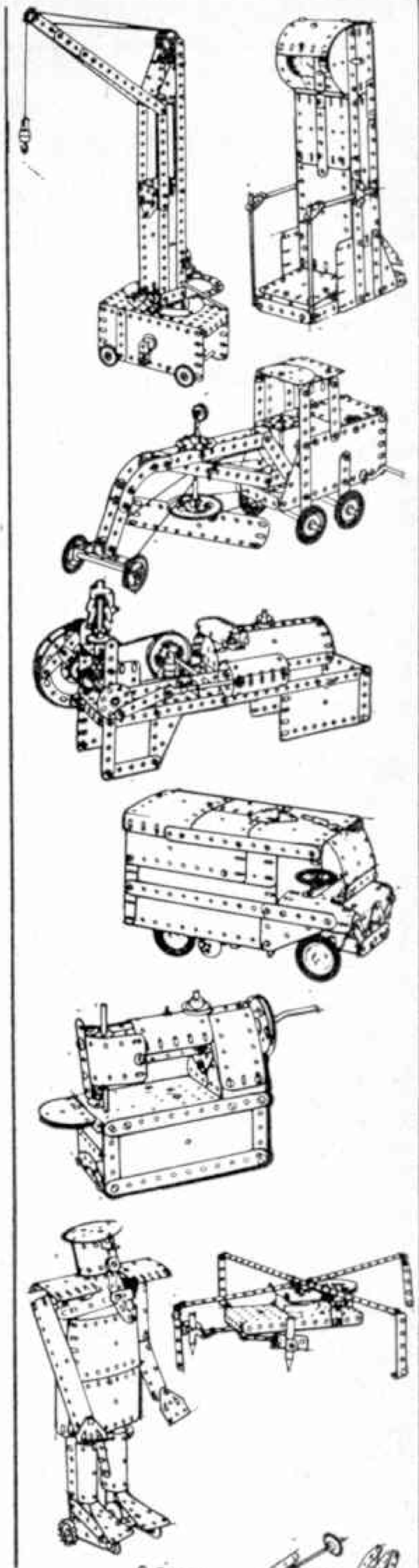

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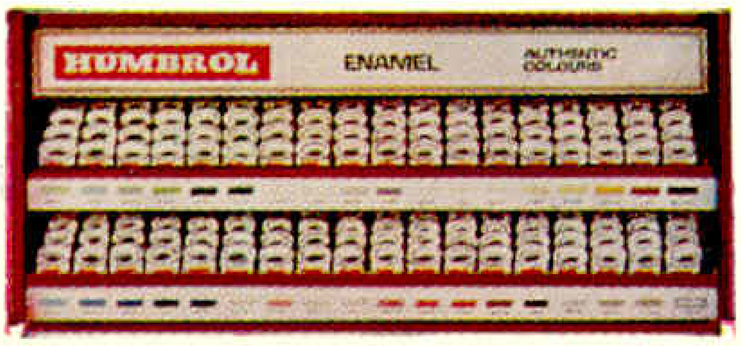

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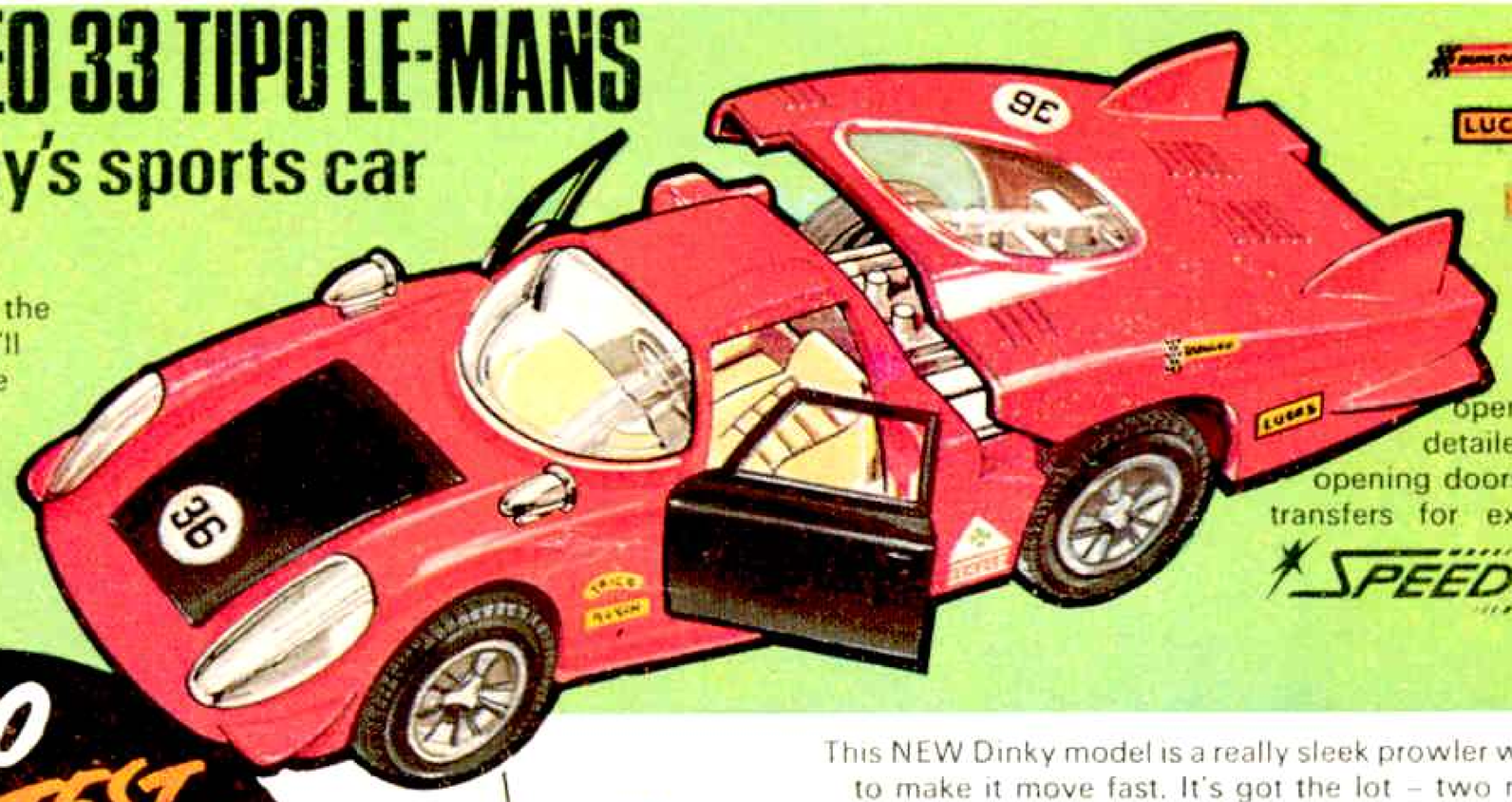

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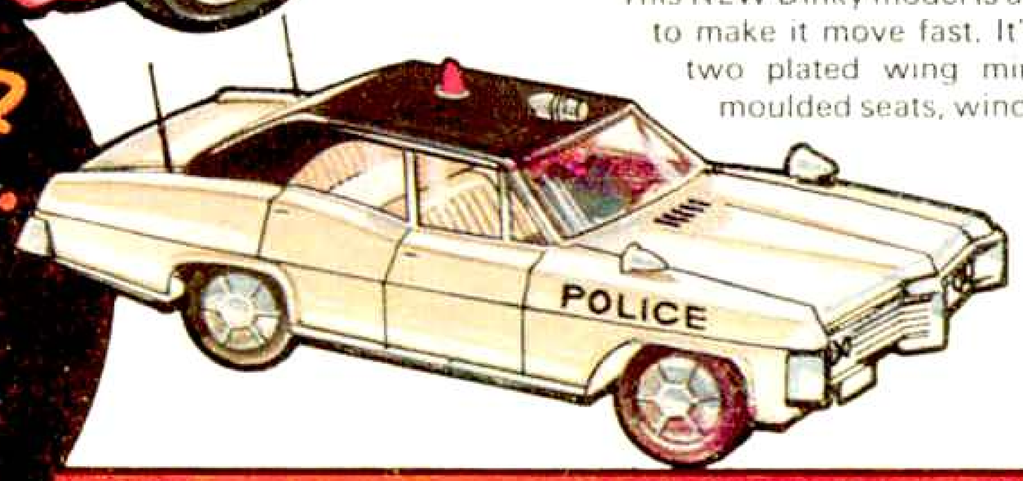

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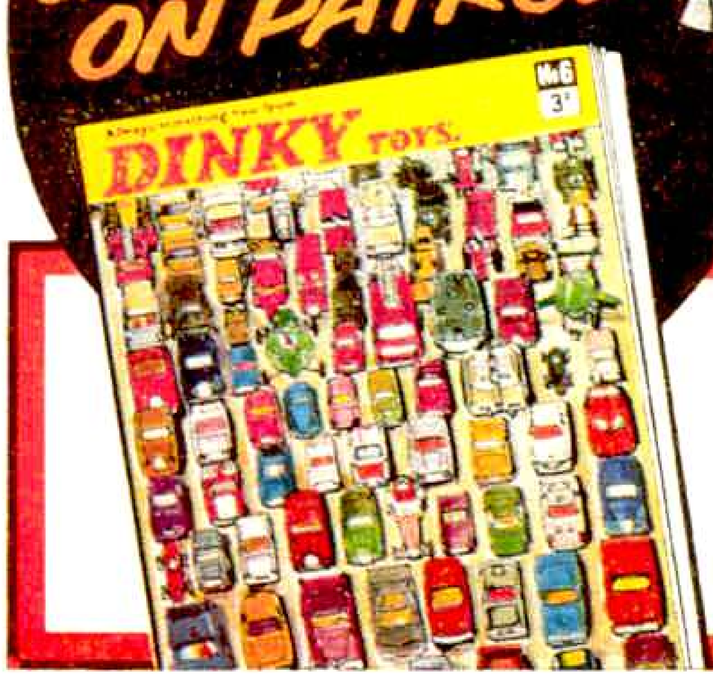

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